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Water-Supply and Irrigation Paper No. 133 Series P, Hydrographic Progress Reports, 38

DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1904

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

BY

M. C. HINDERLIDER, G. L. SWENDSEN, and A. E. CHANDLER

PART X.—Colorado River and The Great Basin Drainage

WASHINGTON

GOVERNMENT PRINTING OFFICE

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
HYDROGRAPHIC BRANCH,
Washington, D. C., April 14, 1905.

SIR: I transmit herewith the manuscript of Part X of a series of twelve papers which compose the Report of Progress of Stream Measurements for the Calendar Year 1904. Parts I to VI of this report contain the results of the data collected in the territory east of Mississippi River. Parts VII to XII are devoted to the data collected in the territory west of Mississippi River.

The larger part of the original data for this report was collected under the direction of Messrs. M. C. Hinderlider, G. L. Swendsen, and A. E. Chandler. Mr. Hinderlider had charge of the operations in Colorado and eastern Utah. He was assisted by R. I. Meeker and Howard S. Reed. Mr. Swendsen had charge of the work in the vicinity of Great Salt Lake, and was assisted by W. D. Beers, Caleb Tanner, and W. G. Swendsen. Mr. Chandler carried on the investigations in Nevada, and was assisted by W. A. Wolfe and J. T. Shaw. A limited amount of the data submitted herewith was collected under the direction of other hydrographers, as noted in the list of acknowledgments. The assembling of the data and the preparation for publication were done under the direction of John C. Hoyt, who has been assisted by R. H. Bolster, Robert Follansbee, Willis E. Hall, and A. H. Horton.

I request that this manuscript be published as one of the series of Water-Supply and Irrigation Papers.

Very respectfully,

F. H. NEWELL, *Chief Engineer.*

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1904.

PART X.

By M. C. Hinderlider, G. L. Swendsen, and A. E. Chandler.

INTRODUCTION.

The hydrographic work of the United States Geological Survey includes the collection of facts concerning, and the study of conditions affecting the behavior of water from the time it reaches the earth as rain or snow until it joins the oceans or great navigable rivers. These investigations became a distinct feature of the work of the Survey in the fall of 1888, when an instruction camp was established at Embudo, N. Mex. Since that date the work has been continually and gradually extended as larger funds became available. The first distinctive appropriation for gaging streams was made by the act of August 18, 1894, which contained an item of $12,500, "for gaging the streams and determining the water supply of the United States, including the investigation of underground currents and artesian wells in the arid and semiarid section." (Digest of Appropriations for 1895, p. 270.)

Since that time a similar act has been passed each year and the appropriations have gradually increased, as shown in the following table:

Annual appropriations for hydrographic surveys.

Year ending June 30, 1895	$12,500
Year ending June 30, 1896	20,000
Year ending June 30, 1897	50,000
Year ending June 30, 1898	50,000
Year ending June 30, 1899	50,000
Year ending June 30, 1900	50,000
Year ending June 30, 1901	100,000
Year ending June 30, 1902	100,000
Year ending June 30, 1903	200,000
Year ending June 30, 1904	200,000
Year ending June 30, 1905	200,000
Year ending June 30, 1906	200,000

The chief feature of the work of the hydrographic division is the systematic study of the flow of the surface waters and the conditions affecting the same. In this connection other information that may be of use to the engineer or others in hydrographic studies, such as river profiles, duration and extent of damage by floods, water-power data, etc., is collected. Furthermore, the work has been so directed that the information collected will be of direct value in the commercial and agricultural development of the country.

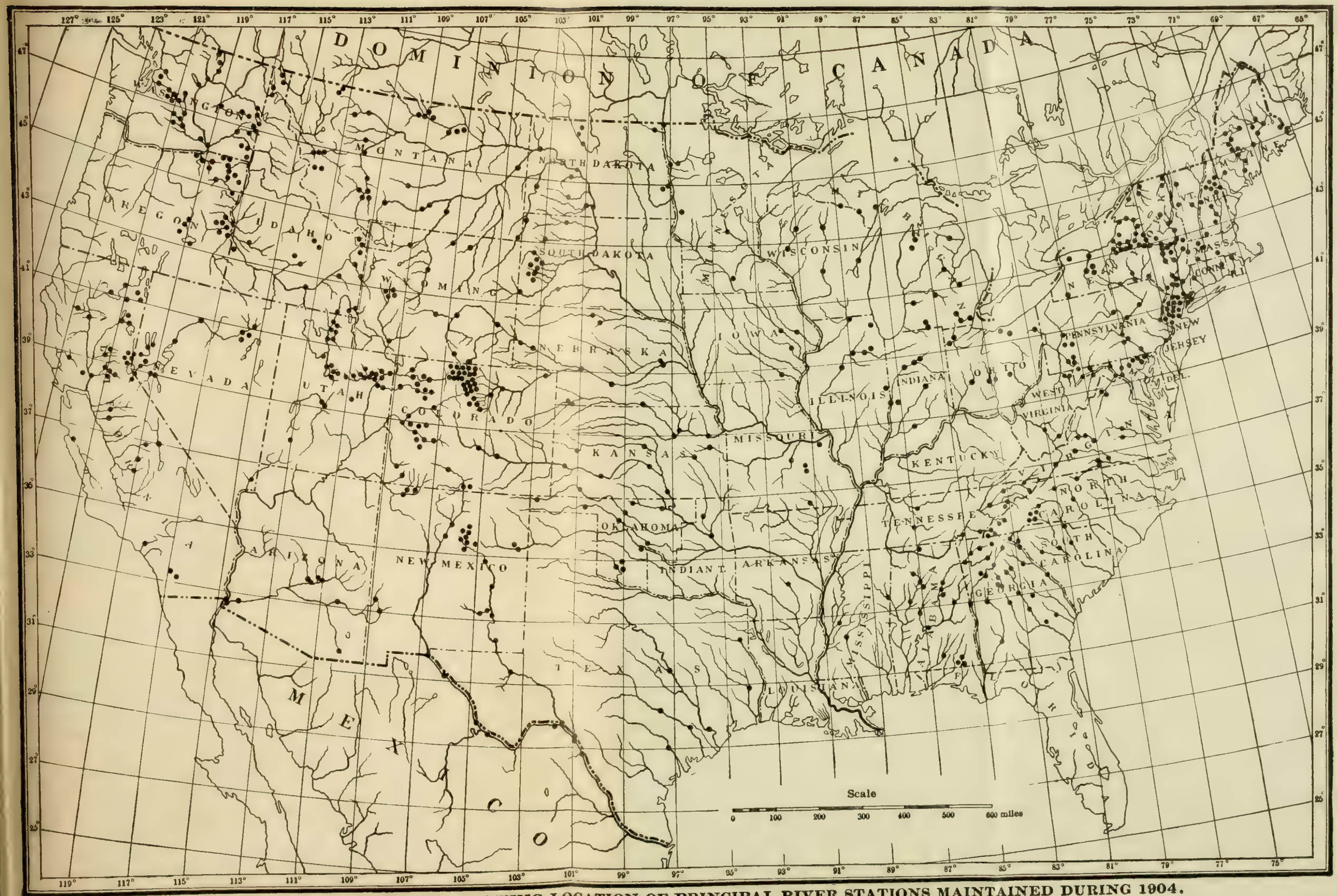
As a result of the increased appropriations since June 30, 1902, the work has been largely extended and thoroughly systemized. The various States have been grouped into districts, each of which is under the supervision of a district hydrographer who, with a corps of assistants, devotes his whole time to the study of the hydrographic resources of his district.

The methods used in the collection of these data and in their preparation for publication are given in detail in Water-Supply Paper No. 94. (Hydrographic Manual, U. S. Geol. Survey.)

The general plan of stream gaging which has been developed is to obtain eventually data in regard to the flow of all the important streams in the United States. With this in view gaging stations are established at points where the data will be of greatest commercial value. At these stations discharge measurements are taken from time to time at typical river stages, and the daily surface fluctuation is obtained by means of gage readings. From these two factors it is possible to estimate both the total flow and its distribution through the period of observations.

The selection of the site for a gaging station and the length of time the station is maintained depend largely upon the needs of each locality. If the stream is to be used for water power, special efforts are made to obtain information concerning the low-water flow. If water is to be stored, the high waters are given special attention. In all sections certain permanent stations are maintained for general statistical purposes to show the conditions which exist through long periods. They also act as primary stations, and are used in connection with short series of measurements to determine the flow in particular portions of the drainage basin.

Gaging stations are divided into two general classes: First, current-meter stations; and second, weir stations. The former class is subdivided as to location into bridge, cable, boat, and wading stations. Fig. 1 shows a cable station with car, tag-line, inclined gage, etc. In addition to the bridge, cable, or boat, the equipment of a current-meter gaging station consists in a gage for determining the daily fluctuations of the water surface, bench marks to which the zero of the gage is referred, and permanent marks on the bridge or a tagged line indicating the points of measurement. Where the current is swift some appli-



MAP OF THE UNITED STATES, SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1904.

ance—generally a secondary cable—is necessary to hold the meter in position below the surface.

Gaging stations are generally located at bridges if the channel conditions are satisfactory, as from them the meter can be easily manipulated, and the cost of the equipment is comparatively small. The stations are located as far as possible at points where the channel is straight, both above and below the gaging section, and where there are no cross currents, backwater, or boils. The bed of the stream should be as clear as possible from large projections and of a permanent character. The banks should be high, and should overflow at high stages only. Great care is taken in the selection and equipment of gaging stations, in order that the data may have the required degree of accuracy.

On many of the larger rivers where water power is developed by dams estimates of flow are obtained by observing the head on the crest and using a weir formula. On the smaller streams sharp-crested weirs are in some cases erected.

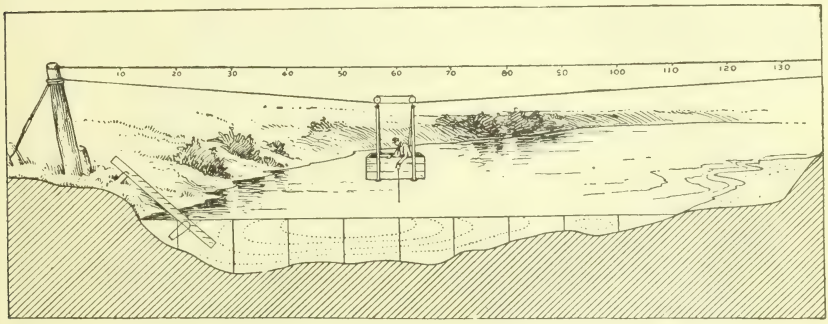


FIG. 1.—Cable station, showing section of river, car, gage, etc.

The principal instrument used in stream-measurement work is the current meter, by which the velocity of the flow of water is determined. After years of experience the Survey has adopted the Price current meter for general work. This meter, as is shown on Pl. II, is made in two sizes, known as the large and small Price. The small Price has been largely developed by the officers of the Survey, using the Price acoustic meter as a basis.

A discharge measurement is the determination of the quantity of water flowing past a certain point at a given time. This quantity is the product of two factors: (1) The mean velocity, which is the function of the cross section, surface slope, wetted perimeter, and roughness of bed; (2) the area, which depends upon the permanency of the bed and the fluctuations of the surface, which govern the depth.

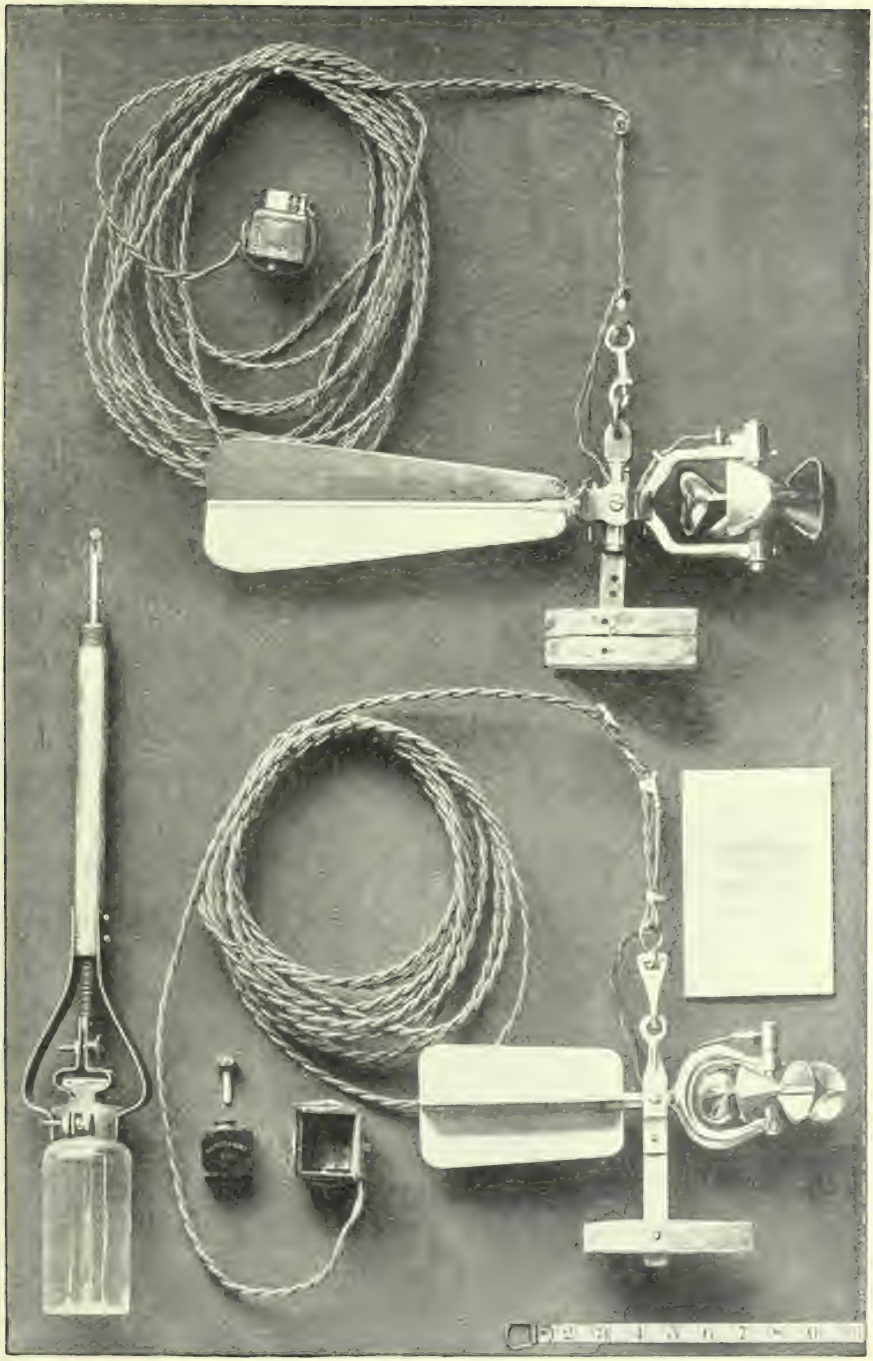
In making the measurement an arbitrary number of points are laid off perpendicular to the thread of the stream (see fig. 1). These points are usually at regular intervals varying from 2 to 20 feet, depending

upon the size and conditions of the stream. They are known as measuring points, and at them the observed data, the velocities, and soundings are taken. The perpendiculars dropped from the measuring points divide the gaging section into strips, and for each strip or pair of strips the mean velocity, area, and discharge are determined independently; thus conditions existing in one part of the stream are not distributed to parts where they do not apply.

The methods of obtaining velocity with the current meters which are in general use may be grouped into three classes: Single point, multiple point, and integration.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth, for which the coefficient for reducing to mean velocity has been determined. Extensive experiments by vertical velocity-curves show that the thread of mean velocity lies at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and it is at this depth that the meter is held in the majority of the measurements, this being known as the six-tenth depth method. It is found by a large number of vertical velocity-curve measurements, taken on various streams and under various conditions, that the coefficient for reducing the velocity obtained at six-tenths depth to mean velocity is practically unity, ranging, in a series of 910 measurements made at 39 gaging stations, between 0.94 and 1.04, with a mean for the 910 observations of 1.00. In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the action of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocities taken at the subsurface has been found by repeated experiments with vertical velocity-curves to be from 0.85 to 0.95, depending upon the depth of the stream and velocity and channel conditions. This method is specially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The three principal multiple-point methods in general use are: The vertical velocity-curve; top and bottom; and top, bottom, and mid depth. In the vertical velocity-curve method a series of velocity determinations are taken in the vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve through these points, the vertical velocity-curve is produced, which shows the change in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the depth into the area bounded by this mean velocity-curve and the initial line. Owing to the length of time it takes to make these measurements, they are seldom used except for determining coefficients for purposes of comparison, and for measurements under ice.



PRICE CURRENT METERS, WITH BUZZERS.

In the second multiple-point method the meter is held from 0.5 to 1 foot below the surface and about 0.5 foot above the bottom, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. This method is not well adapted for general work, as the roughness of the bottom disturbs the velocity at that point. For shallow streams with comparatively smooth beds good results are obtained by this method. In the third multiple-point method the meter is held at mid depth, at 0.5 foot below the surface and at 0.5 foot above the bottom, and the mean velocity is determined by dividing the sum of the top velocity, twice the mid-depth velocity, and the bottom velocity, by 4.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface. The number of revolutions and the time taken in the operation is noted, and the mean velocity is found by dividing the number of revolutions by the number of seconds taken in the run. This method has the advantage in that the velocity at each point of the vertical is measured twice. It is well adapted for measurements under ice and as a check on the point methods.

The area, which is the other factor for determining the discharge of the stream, depends upon the stage of the river, which is taken on a gage, and the general contour of the bed of the stream, which is found by sounding. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For stations with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also used for obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at the various points of measurements the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or double strip. The total discharge and area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The volume of water flowing in a stream is known as run-off. In expressing it various units are used, depending upon the kind of work for which the data are needed. Those used in this report are "second-feet," "acre-feet," "run-off per square-mile," and "run-off in depth in inches," and may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second, and is the body of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second.

The "acre-foot" is the unit of capacity used in connection with storage for irrigation work, and is equivalent to 43,560 cubic feet. It is the quantity required to cover an acre to a depth of 1 foot. There is a convenient relation between the second-foot and the acre-foot; 1 second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, which equals 1.9835 acre-feet, or, approximately, 2 acre-feet.

The expression "second-feet per square mile" means the average number of cubic feet of water flowing each second from every square mile of drainage area on the assumption that the run-off is uniformly distributed

"Depth in inches" means the depth of water in inches that would have covered the drainage area, uniformly distributed, if all the water could have accumulated on the surface. This quantity is used for comparing run-off with rainfall, which quantity is usually given in depth in inches.

It should be noticed that "acre-feet" and "depth in inches" represent the actual quantities of water which are produced during the periods in question, while "second-feet," on the contrary, is merely a rate of flow per second.

The base data for computing the daily gage heights and the daily discharge of a stream are the various discharge measurements, of which there should be sufficient number to cover the range of stage. The fundamental laws upon which these computations are based are the following:

(1) The discharge will remain constant so long as the conditions at or near the gaging station remain constant;

(2) Neglecting the change of slope due to the rise and fall of the stream, the discharge will be the same whenever the stream is at a given stage; and

(3) The discharge is both a function of, and increases gradually with, the gage heights. (2 and 3 depend on 1.)

As the beds of many streams are changeable, the problem divides itself into two classes: (1) Those of streams with permanent or practically permanent beds, and (2) those of streams with changeable beds. The base data and methods of obtaining them are the same for either class, and it is only in the computation of the mean daily flow that different methods are necessary.

In determining the daily discharge of streams with permanent beds, the results of the discharge measurements are plotted on cross-section paper, with gage heights as ordinates and discharges as abscissas. Through these points a smooth curve is drawn, which shows the discharge for any gage height, and from which a rating table is prepared. The mean velocity and area determined for each discharge measurement are also platted. Through these points the curves of mean

velocity and of area are drawn, and the rating curve is largely determined by taking the product of the mean velocity and the area at various stages as determined by these curves. These curves of mean velocity and area are of special value in determining the location of the rating curve for stages at which actual discharge measurements are not available and for extending the discharge curve outside the limits of the measurements. In the preparation of the rating table the discharge for each tenth or half-tenth on the gage is found from the curve. The first and second differences of these discharges are then taken and adjusted according to the law that they shall either be constant or increasing, never decreasing. The discharges in the table are then changed in accordance with these adjusted differences. In making up the station-rating curve, the individual discharge measurements and the conditions under which they were taken are carefully studied, in order that proper weight shall be given to each measurement. Rating curves in general take the form of a parabola, and as a rule the high-water portion of the curve approaches a straight line. For stations of permanent character, the results of the measurements from year to year should be within 5 per cent of the curve, with the exception of those taken during high water, when the probable error may be as high as 10 per cent.

The determination of the daily discharge of streams with changeable beds is difficult, and unless frequent discharge measurements are made, the results obtained are only roughly approximate. For streams with continually shifting beds, such as Colorado River and the Rio Grande, discharge measurements are made every two or three days, and the discharges for the intervening days are obtained by interpolation, modified by the gage heights for these days. For stations with beds which shift slowly, or are only materially changed during floods, station rating curves and tables can be prepared for the periods between changes, and satisfactory results can be obtained with two or three measurements a month, providing measurements are taken soon after the changes occur.

In determining the flow for periods when the streams are frozen, special rating curves and tables have to be prepared from measurements taken under these conditions. The methods of constructing these curves and tables are the same as for open sections. The discharge measurements, however, are taken either by integration in verticals or by the vertical-velocity curve method, as sufficient experiments have not been made on ice-covered streams to determine the laws which govern the position of the thread of mean velocity.

The Report of Progress of Stream Measurements for the Calendar Year 1904, of which this is Part X, is published in a series of twelve

Water-Supply Papers, Nos. 124–135, inclusive, under the following subtitles:

Part 1. Atlantic coast of New England drainage.

Part 2. Hudson, Passaic, Raritan, and Delaware River drainages.

Part 3. Susquehanna, Patapsco, Potomac, James, Roanoke, Cape Fear, and Yadkin River drainages.

Part 4. Santee, Savannah, Ogeechee, Altamaha rivers, and Eastern Gulf of Mexico drainage.

Part 5. Eastern Mississippi River drainage.

Part 6. Great Lakes and St. Lawrence River drainage.

Part 7. Hudson Bay, Minnesota, Wapsipinicon, Iowa, Des Moines, and Missouri River drainages.

Part 8. Platte, Kansas, Meramec, Arkansas, and Red River drainages.

Part 9. Western Gulf of Mexico drainage.

Part 10. Colorado River and the Great Basin drainage.

Part 11. The Great Basin and Pacific Ocean drainage in California.

Part 12. Columbia River and Puget Sound drainage.

The territory covered by each paper is given in the subtitle, and the larger drainages are, for convenience in arrangement, subdivided into smaller ones, under which the data are arranged, as far as practicable, geographically.

These papers contain the data that have been collected at the regular gaging stations, the results of the computations based upon the observations and such other information that has been collected that has a direct bearing on these data, including, as far as practicable, descriptions of the drainage areas and the streams draining them.

For each regular station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage height table.
4. Rating table.
5. Table of estimated monthly and yearly discharges and run-off.

The descriptions of stations give, as far as possible, such general facts about the locality and equipment as would enable the reader to find the station and use the same. They also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge measurement table gives the results of the discharge measurements made during the year. This includes the date, the hydrographer's name, the gage height, and the discharge in second-feet.

The table of daily gage heights gives for each day the mean height of the surface of the river as found from the mean of the gage readings taken on that day. At most of the stations the gage is read in the morning and in the evening.

The rating table gives discharges in second-feet corresponding to each stage of the river as given by the gage heights.

In the table of estimated run-off the column headed "Maximum" gives the mean flow for the day when the mean gage height was the highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" gives the average flow for each second during the month. Upon this mean the computations for the three remaining columns which are defined on pages 15-16 are based.

In the computations for the tables of this report the following general and special rules have been used:

Fundamental rules for computation.

1. The highest degree of precision consistent with the rational use of time and money is imperative.

2. All items of computation should, in general, be expressed by at least two and by not more than four significant figures.

3. Any measurement in a vertical velocity, mean velocity, or discharge curve whose per cent of error is 5 times the average per cent error of all the other measurements should be rejected.

4. In reducing the number of significant figures, or the number of decimal places, by dropping the last figure, the following rules apply:

(a) When the figure in the place to be rejected is less than 5, drop it without changing the preceding figure. Example: 1,827.4 becomes 1,827.

(b) When the figure in the place to be rejected is greater than 5, drop it and increase the preceding figure by 1. Example: 1,827.6 becomes 1,828.

(c) When the figure in the place to be rejected is 5, and it is preceded by an even figure, drop the 5. Example: 1,828.5 becomes 1,828.

(d) When the figure in the place to be rejected is 5, and it is preceded by an odd figure, drop the 5 and increase the preceding figure by 1. Example: 1,827.5 becomes 1,828.

5. In constructing and applying rating tables a maximum limit of one-half per cent error should seldom be exceeded.

Special rules for computation.

1. Rating tables are to be constructed as close as the data upon which they are based will warrant. No decimals are to be used when the discharge is over 50 second-feet.

2. Daily discharges shall be applied directly to the gage heights as they are tabulated.

3. Monthly means are to be carried out to one decimal place when the quantities are below 100 second-feet. Between 100 and 10,000 second-feet, the last figure in the monthly mean shall be a significant figure. This also applies to the yearly mean.

4. Second-feet per square mile and depth in inches for the individual months shall be carried out at least to three significant figures, except in the case of decimals, where the first significant figure is preceded by one or more naughts (0), when the quantity shall be carried out to two significant figures. Example: 1.25; .125; .012; .0012. The yearly means for these quantities are always to be expressed in three significant figures and at least two decimal places.

The results of the stream measurements made during previous years by the United States Geological Survey can be found in the following Survey publications. A detailed index of these reports (from 1888–1903) is given in Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II.
1889. Eleventh Annual Report, Part II.
1890. Twelfth Annual Report, Part II.
1891. Thirteenth Annual Report, Part III.
1892. Fourteenth Annual Report, Part II.
1893. Bulletin No. 131.
1894. Bulletin No. 131; Sixteenth Annual Report, Part II.
1895. Bulletin No. 140.
1896. Water-Supply Paper No. 11; Eighteenth Annual Report, Part IV.
1897. Water-Supply Papers Nos. 15 and 16; Nineteenth Annual Report, Part IV.
1898. Water-Supply Papers Nos. 27 and 28; Twentieth Annual Report, Part IV.
1899. Water-Supply Papers Nos. 35 to 39, inclusive; Twenty-first Annual Report, Part IV.
1900. Water-Supply Papers Nos. 47 to 52, inclusive; Twenty-Second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65 and 75.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75.
1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124 to 129, inclusive.
West of Mississippi River, Water-Supply Papers Nos. 130 to 135, inclusive.

A limited number of these are for free distribution, and as long as the supply lasts they may be obtained by application to the Director United States Geological Survey or to members of Congress. Other copies are filed with the Superintendent of Public Documents, Washington, D. C., from whom they may be had at prices little above cost. Copies of Government publications are, as a rule, furnished to the public libraries in our large cities, where they may be consulted by those interested.

COOPERATION AND ACKNOWLEDGMENTS.

Most of the measurements presented in this paper have been obtained through local hydrographers. Acknowledgment is extended to other persons and corporations who have assisted local hydrographers or have cooperated in any way, either by furnishing records of the height of water or by assisting in transportation.

The following list, arranged alphabetically by States, gives the names of the resident hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

Arizona.—District hydrographers, C. G. Williams and W. A. Farish,[a] assisted by W. Richins, O. Richins, R. H. Ross, and H. R. Fry.

California.—The hydrographic work of the United States Geological Survey in California has been carried on in cooperation with the State, in accordance with an act of the State legislature approved March 16, 1903, which is in substance as follows:

"The State board of examiners are hereby empowered to enter into contracts with the Director of the United States Geological Survey for the purpose of making topographic maps to the extent of twenty thousand dollars; also for the purpose of gaging streams, surveying reservoir sites and canal locations, for the conservation and utilization of the flood or storm waters of the State to the extent of fifteen thousand dollars," etc.

The State board of examiners is composed of the following members, viz: George C. Pardee, governor; C. F. Curry, secretary of State; U. S. Webb, attorney-general; Walter S. Mellick, secretary.

Although the portion of the bill referring to hydrographic work provides for making surveys of reservoir sites and canal locations none of the State money has been expended for this purpose; the Geological Survey has made these investigations on Putah Creek, Sacramento River, Pit River and tributaries, Owens River, and Colorado River, and has paid the entire expense from its own funds.

The State appropriation, $7,500 of which became available July 1, 1903, has been used exclusively for gathering general stream-flow data; the Survey also apportioned $10,400 for the same purpose for the fiscal year beginning July 1, 1903. At this time 28 gaging stations were being maintained in California; other stations were added, and on December 31, 1903, 56 stations were being maintained. The data being accumulated for each of these stations has a specific value in connection with the future development of the resources of the State. The information will be invaluable in designing and making estimates of cost for storage, irrigation, power, and drainage works, and for use in litigation.

The work in the western and southern portions of California was under the direction of the supervising engineer, J. B. Lippincott,[b] assisted by hydrographers Samuel G. Bennett and W. B. Clapp. Acknowledgments are also due to the following individuals and corporations for assistance rendered and data furnished: To the Kern County Land Company, through A. K. Warren, engineer in charge of water measurements, for the record of Kern River; to the city of Santa Barbara for cooperation in gaging Santa Ynez River and Mono Creek; to the Southern Pacific Railway Company through its chief engineer, William Hood, for river stage records of San Joaquin River at Herndon, Cal., and King River at Kingsburg, and for transportation furnished supervising engineer and assistants; and to the officials of the Santa Fe Route for transportation furnished to the supervising engineer and assistants.

The work in the extreme eastern portion of California was carried on under the direction of L. H. Taylor,[c] engineer, United States Geological Survey, and A. E. Chandler, State engineer of Nevada, assisted by W. A. Wolf, J. T. Shaw, R. A. Craig, O. F. Heizer, and L. A. Woolley. Acknowledgment is due to the Southern Pacific Railway Company, for transportation furnished the district hydrographers and assistants.

Colorado.—District and resident hydrographer, M. C. Hinderlider;[d] assisted by R. I. Meeker, assistant engineer; Oro McDermith, William A. Lamb, George B. Monk, L. E. Foster, hydrographers; and Melvin Beeson, Thomas E. Brick, Theodore Tobish, and F. L. Meeker, office assistants. Acknowledgments are due the Denver and Rio Grande; Colorado and Southern; Burlington and Missouri River;

[a] Office, Phoenix, Arizona.
[b] Office, 1108 Braly Building, Los Angeles, California.
[c] Office, Hazen, Nevada.
[d] Office, Chamber of Commerce Building, Denver, Colorado.

Union Pacific; Rio Grande Southern; and Atchison, Topeka and Santa Fe railroads for free transportation for hydrographers over their lines.

Idaho.—District engineer, D. W. Ross,[a] assisted by Fred Stockton, William G. Davies, and J. B. Bond.

Nevada.—The hydrographic work in this section has been carried on in cooperation with the State by L. H. Taylor,[b] engineer, United States Geological Survey, and A. E. Chandler, State engineer, assisted by W. A. Wolf, J. T. Shaw, R. A. Craig, O. F. Heizer, H. H. Church, and L. A. Woolley. Acknowledgment is due to the Southern Pacific Railway Company for transportation furnished the district hydrographers and assistants and also to the San Pedro, Los Angeles and Salt Lake Railroad Company for transportation furnished the State engineer.

New Mexico.—The hydrographic work in the northern portion of this Territory was carried on under the direction of the district hydrographer, M. C. Hinderlider,[c] assisted as follows: The work in the north-central portion was in charge of George B. Monk; that in the extreme eastern portion was in charge of W. G. Russell; while the work in the northwestern portion was in charge of Robert C. Prewitt. For many favors and courtesies in the form of free accommodations to hydrographers and for assistance in securing records of flow on Mora River, acknowledgments are due D. C. Duel, Hugh London, and J. J. Baer, of Lacueva, N. Mex.; also to James D. Hand, of Las Alamos, N. Mex., for similar favors. Transportation in the form of an annual pass was furnished George B. Monk by the Denver and Rio Grande Railroad, and to W. G. Russell by the Chicago, Rock Island and El Paso Railroad. For the purpose of collecting data in New Mexico during the latter part of the year an annual pass over the Atchison, Topeka and Santa Fe Railroad was issued to George B. Monk, for which acknowledgments are due.

Oregon.—District engineer, John T. Whistler,[d] assisted by John H. Lewis during the first quarter, and by Wilbur C. Sawyer, Edwards N. Smith, and Ivan Landes the remainder of the year. Acknowledgment and thanks are due the Oregon Railroad and Navigation Company; Southern Pacific Railway Company; Oregon Short Line Railroad Company; Sumpter Valley Railway; and the Columbia Southern Railway for transportation; to the Pacific Live Stock Company, through Mr. Gilchrist, superintendent, for gratuitous gage readings; and to W. C. McDonald for the use of his ferry cable on John Day River as a gaging station.

Utah.—District engineer, George L. Swendsen,[e] assisted by W. D. Beers, Caleb Tanner, W. G. Swendsen, Henry S. Kleinschmidt, and Horace W. Sheley. Acknowledgments are also due to the Oregon Short Line; Denver and Rio Grande; and San Pedro, Los Angeles and Salt Lake railway companies for transportation; to the Telluride Power Company, Logan River canal companies, Jordan River canal companies, Salt Lake engineer, J. Fewson Smith, jr., water commissioner for Jordon Valley, William Knight, superintendent of pumping plant at Utah Lake, and others who have given assistance from time to time. All daily papers of the State have supported the work strongly, and have done much to emphasize the importance of hydrographic information to a proper development of irrigation interests.

The hydrographic work in the Uinta Indian Reserve has been carried on under the direction of the district hydrographer, M. C. Hinderlider, by the resident hydrographer, Howard S. Reed.

Wyoming.—The hydrographic work in this State has been carried on under the direction of the district hydrographer, M. C. Hinderlider,[f] by the resident hydrographer, A. J. Parshall. Acknowledgments are due for annual passes over all their lines in Wyoming, to the Union Pacific, Chicago, Burlington and Quincy; Colorado and Southern; Colorado and Wyoming, and Fremont, Elkhorn and Missouri River Valley railroads.

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[a] Office, Boise, Idaho.
[b] Office, Hazen, Nevada.
[c] Office, Chamber of Commerce Building, Denver, Colorado.
[d] Office, Pendleton, Oregon.
[e] Office, Salt Lake, Utah.

COLORADO RIVER DRAINAGE BASIN.

Colorado River is formed by Grand and Green rivers in the northeastern part of Utah. It flows in a southerly direction, passing into Arizona, from whence it flows westerly to the Nevada State line. From here it continues in a southerly direction, forming the boundary between Arizona, California, and Nevada. At Yuma it enters Old Mexico, and a few miles below empties into the northern extremity of the Gulf of California.

The drainage area of Colorado River, which is 225,000 square miles above Yuma, Ariz., comprises the southwest part of Wyoming, the western part of Colorado, the eastern half of Utah, practically all of Arizona, and a small portion of California and Nevada. Most of this area is arid, having a mean annual rainfall of about 8½ inches. The river receives its water supply from the melting snows of the high mountains of Wyoming, Utah, and Colorado.

The water of the Colorado carries a large amount of sediment, reaching as high as 2,000 parts of sediment to 100,000 parts of water. The minimum amount is carried during the winter months, and probably is never less than 60 parts of sediment to 100,000 parts of water.

Prof. R. H. Forbes, in Bulletin No. 44, University of Arizona agricultural experiment station, says:

> On the basis of the profile constructed from available data for the volume of flow of the Colorado, and of the year's silt determinations made in this laboratory, it is estimated conservatively that the river during 1900 brought down about 81,000,000 tons of sedimentary material, which, condensed to the form of solid rock, is enough to cover 26.4 square miles 1 foot deep, or to make 53 square miles of dry, alluvial soil 1 foot deep, or to make about 164 square miles of recently settled, submerged mud 1 foot deep, reckoning the whole amount of mud for the year to average 6.2 times the bulk of the solid sediment.

A comparatively small amount of land is irrigated by the waters of Colorado River, owing to the fact that the main stream and both of its tributaries are situated so far below the level of the irrigable lands as to render their diversion extremely difficult or impracticable.

There are two pumping plants that lift water for irrigation at Yuma and several at other points on the river above Yuma. The Imperial canal diverts water at a point on the right bank of the river 10 miles by river below Yuma. It is the intention of the owners of this canal to reclaim a large tract of fertile land situated in Mexico and in California.

In a reconnaissance of Colorado River by J. B. Lippincott, numerous dam and reservoir sites and diversion points for canals were discovered, together with large tracts of fertile land capable of being irrigated. In November, 1902, extensive topographic, soil, and hydrographic surveys were begun in the Colorado River Valley by the Reclamation Service of the Geological Survey.

Colorado River has been called the Nile of America, and, like the Nile, it is subject to an annual summer rise, which comes at the time when it is most needed for irrigation. It is of interest to compare the Colorado with the Nile and Susquehanna rivers, the Nile being of a similar type, while the Susquehanna shows the difference of flow from arid and humid regions. In this comparison a normal year based upon the past ten years' records for the Colorado and Susquehanna rivers and such data as could be found in regard to the Nile has been used. The Colorado has been used as the standard for comparison.

The Nile has 5.7 times the drainage area and the Susquehanna about one-eighth the area.

The rainfall in the Nile basin is 3.8 times greater and that in the Susquehanna basin is about 4½ times greater.

The discharge of the Nile is 10.8 greater. That of the Susquehanna is 4½ times greater.

The run-off per square mile from the Nile basin is 1.9 times greater and that of the Susquehanna is 37 times greater.

The ratio of run-off to rainfall in the Nile basin is 2 times smaller and that of the Susquehanna is 8⅕ times greater.

The maximum flow of the Colorado is from 70,000 to 75,000 second-feet and occurs in either May, June, or July. For the Nile it is about 353,000 second-feet and occurs about the 1st of September. For the Susquehanna it is from 200,000 to 400,000 second-feet and occurs during March, April, and May.

The mean flow of the Colorado is about 10,700 second-feet. For the Nile it is about 115,800 second-feet, and that for the Susquehanna is 43,000 second-feet.

The minimum flow of the Colorado is from 2,500 to 3,000 second-feet, and occurs during January and February. The minimum flow of the Nile is about 14,500 second-feet, and occurs about the end of May. For the Susquehanna it is from 2,500 to 5,000 second-feet, and occurs in September and October.

The principal tributaries of Colorado River are as follows: Gila River rises in the western part of New Mexico and flows west into the Colorado at Yuma, Ariz., draining the southern half of Arizona. Salt River, its principal tributary, joins it about 15 miles west of Phoenix, Ariz. Verde River and Tonto Creek are tributaries of Salt River from the north. San Juan River, with its tributaries, drains southwestern Colorado, northwestern New Mexico, and northeastern Arizona. It takes a generally westward course, joining the Colorado north of the Utah-Arizona boundary. Animas, Los Pinos, and Florida rivers are tributaries in southwestern Colorado. Grand River has its source on the Continental Divide, in the northern part of Colorado, and flows southwest to its junction with Green River. Gunnison River, its prin-

cipal tributary, joins it from the south, a short distance south of Grand Junction, Colo. Dolores River rises in southwestern Colorado and flows northwest into the Grand, in eastern Utah. Green River rises in the Wind River Mountains in the western-central part of Wyoming, its main source being in the lofty peaks of the Continental Divide. The source of its tributaries is also among the higher snow-covered ranges, maintaining the volume of this stream late into the summer. The principal branches of White River rise in White River Plateau, a well-forested tract in the White River Forest Reserve. A number of lakes, among which are Oyster, Marvin, Traverse, and Deep lakes, furnish important reservoir sites, if such are ever needed. Duchesne River, with its tributaries, Uinta River, Lake Creek, and Whiterocks River, flows into the Green near the mouth of White River and near Ouray, Utah. The Ashley is a small tributary of the Green, in northeastern Utah. Yampa River rises in the eastern part of Routt County, Colo., flows in a general westerly direction through the entire county, and empties into Green River near the western boundary. The stream is somewhat peculiar in its character, the upper branches having considerable fall, and the water, flowing rapidly over shoals of gravel and rock, is easily taken out for utilization.

COLORADO RIVER AT YUMA, ARIZ.

This station is located in the town of Yuma, Ariz., 1½ miles below the mouth of Gila River and 10 miles by river above the Mexican boundary. Records of the river height have been kept by the Southern Pacific Railway Company since April 1, 1878, on the gage which was established by Arthur Brown, superintendent of the bridge and building department of the Southern Pacific Railway Company, during the summer of 1876. The lower section of the rod, reading from 10 to 22 feet, is nailed to the pile protection on the right bank of the Southern Pacific Railway bridge. The upper section, reading above 22 feet, is fastened on the lower side of the first bridge pier from the left bank. This gage height, plus 100 feet, is the Southern Pacific elevation above the sea level. At a later date the Southern Pacific Railway Company established a vertical gage rod (the old rod still remaining) fastened to the pile protection on the left bank of the river just below the railway bridge. This gage has been used continuously since it was established (date unknown), and is the one used by the United States Geological Survey at present. It corresponds in elevation to the old gage established in 1876. The gage is read twice daily by W. D. Smith, who is employed as local hydrographer for the stations in this vicinity.

Discharge measurements are made by means of a ¾-inch cable supported on masts. At low water measurements are made from a boat held in place by a cable. A car is used at flood stages. The

initial point for soundings is the cable support on the south bank, about 20 feet from the water's edge at high water. The cable has a span of 650 feet. At low water the channel has a width of 325 feet. During floods a large part of the water flows through an old channel, and does not pass under the cable. It is measured at the point where it passes under the railway trestle. The channel of the main river is straight for 600 feet above and 5,000 feet below the station. The current is swift and the gaging section regular. The right bank is low, wooded, and liable to overflow. The left bank is not subject to overflow. The bed of the stream is composed of silt and sand and is very unstable. At low water a sand bar forms, which divides the channel into two parts. The bench mark is located on the first pier from the left bank. It is a standard bronze cap United States Geological Survey bench mark and has an elevation of 137 feet above sea level, as determined by the topographic branch of the Geological Survey. Its elevation above the zero of the gage is 35.31 feet.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Colorado River at Yuma, Ariz., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 2	W. D. Smith	18.92	3,981
January 5	do	18.84	4,007
January 8	do	18.75	3,677
January 11	do	18.60	3,494
January 14	do	18.55	3,418
January 16	do	18.70	3,512
January 19	do	18.60	3,407
January 21	do	18.75	3,694
January 23	do	18.75	3,586
January 26	do	18.70	3,511
January 28	do	18.75	3,595
January 30	do	18.80	3,622
February 1	do	18.85	3,649
February 4	do	18.90	3,812
February 6	do	18.90	3,736
February 9	do	18.75	3,484
February 11	do	18.70	3,342
February 13	do	18.75	3,540
February 16	do	18.75	3,490
February 18	do	18.95	3,753
February 20	do	19.05	3,794
February 22	do	19.20	4,162

Discharge measurements of Colorado River at Yuma, Ariz., in 1904—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 25	W. D. Smith	19.35	4,229
February 27	do	19.25	4,247
March 1	do	19.45	4,446
March 3	do	19.50	4,627
March 5	do	19.55	4,725
March 8	do	19.70	4,943
March 10	do	19.90	5,526
March 12	do	20.00	5,720
March 14	do	20.55	9,320
March 15	do	20.25	8,141
March 17	do	19.90	7,111
March 19	do	19.85	6,645
March 22	do	19.80	5,795
March 25	do	19.95	5,861
March 29	do	20.15	6,250
March 31	do	20.05	5,971
April 2	do	20.00	5,926
April 5	do	20.15	6,046
April 7	do	20.50	7,033
April 9	do	20.40	6,984
April 11	do	20.05	6,430
April 14	do	19.95	5,847
April 16	do	19.95	5,823
April 19	do	20.15	6,323
April 21	do	20.25	5,964
April 23	do	20.30	6,173
April 26	do	21.30	13,534
April 28	do	21.80	17,605
April 29	do	22.00	19,204
May 2	do	21.70	17,838
May 4	do	21.70	17,959
May 6	do	21.50	17,046
May 7	J. N. Johannsen	21.85	18,407
May 9	W. D. Smith	22.30	20,916
May 10	do	22.95	26,036
May 11	do	22.85	25,605
May 14	do	22.50	22,854
May 16	do	22.60	23,123
May 19	do	22.90	25,083
May 21	do	23.55	32,200

Discharge measurements of Colorado River at Yuma, Ariz., in 1904—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 23	W. D. Smith	23.95	32,523
May 25	do	24.10	35,653
May 27	J. N. Johannsen	24.70	40,839
May 31	do	25.40	46,677
June 2	do	25.95	46,956
June 5	W. D. Smith	26.25	49,485
June 7	do	26.00	51,170
June 9	do	25.90	49,183
June 11	do	25.50	45,820
June 13	J. N. Johannsen	24.90	42,295
June 15	W. D. Smith	24.70	34,256
June 17	do	24.80	38,192
June 20	do	25.00	38,981
June 22	do	25.40	43,202
June 24	do	25.70	45,435
June 27	do	25.65	43,706
June 29	do	25.55	44,909
July 2	J. N. Johannsen	25.15	35,701
July 5	do	24.25	32,421
July 7	W. D. Smith	24.00	32,186
July 9	S. M. Smith	23.80	27,608
July 11	do	23.40	23,675
July 13	do	23.00	22,761
July 15	do	23.05	22,269
July 18	do	22.85	21,050
July 21	do	22.55	18,681
July 22	do	22.50	18,178
July 25	do	22.20	15,269
July 28	do	22.25	16,044
July 30	do	21.90	13,939
August 1	do	22.20	16,193
August 4	do	22.25	15,973
August 6	do	21.85	15,427
August 8	do	22.15	16,357
August 12	W. D. Smith	21.95	17,686
August 16	do	21.95	16,660
August 18	do	21.65	14,636
August 20	do	21.50	14,199
August 23	do	21.30	12,957
August 24	do	23.00	23,652

Discharge measurements of Colorado River at Yuma, Ariz., in 1904—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 26	W. D. Smith	22.25	18,740
August 30	S. M. Smith	22.80	23,185
September 1	do	22.10	18,358
September 5	do	22.00	18,060
September 7	do	22.40	18,351
September 9	do	21.80	15,773
September 13	do	21.00	12,940
September 15	do	20.90	11,772
September 19	do	20.35	8,063
September 22	W. D. Smith	20.10	7,682
September 26	do	19.60	6,508
September 28	do	19.45	5,984
September 30	do	19.30	5,538
October 4	do	19.30	6,014
October 6	do	20.95	12,408
October 10	do	20.90	11,193
October 14	do	21.85	19,134
October 17	do	22.35	21,603
October 19	do	21.15	14,579
October 22	do	20.60	11,476
October 25	do	20.20	10,055
October 29	do	19.95	8,825
November 1	do	20.00	7,964
November 5	do	19.85	6,955
November 8	do	19.65	6,544
November 12	do	19.65	6,430
November 15	do	19.65	6,423
November 19	do	19.50	5,948
November 23	do	19.30	5,269
November 26	do	19.10	5,156
November 30	do	19.05	4,754
December 3	do	19.10	5,080
December 6	do	19.05	4,797
December 10	do	19.00	4,819
December 13	do	18.85	4,696
December 17	do	18.85	4,756
December 19	do	19.10	4,822
December 24	do	18.40	3,641
December 29	do	18.40	3,933

Mean daily gage height, in feet, of Colorado River at Yuma, Ariz., for 190 .

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	18.92	18.85	19.45	20.05	22.00	25.70	25.30	22.25	22.10	19.30	20.00	19.10
2	18.92	18.85	19.50	20.00	21.75	25.90	25.15	22.20	22.00	19.30	20.00	19.10
3	18.88	18.90	19.50	20.00	21.80	26.10	24.90	22.20	22.10	19.30	20.00	19.10
4	18.84	18.90	19.55	20.00	21.70	26.25	24.45	22.25	22.40	19.30	19.90	19.05
5	18.84	18.90	19.55	20.15	21.50	26.25	24.25	21.95	21.95	19.55	19.85	19.00
6	18.84	18.90	19.55	20.20	21.50	26.20	24.05	21.85	22.25	20.95	19.80	19.00
7	18.79	18.85	19.60	20.50	21.85	26.00	24.00	22.10	22.30	20.30	19.70	19.05
8	18.75	18.80	19.70	20.60	22.10	25.90	23.95	22.10	22.00	20.20	19.65	19.05
9	18.74	18.75	19.80	20.40	22.30	25.90	23.80	22.25	21.75	20.30	19.60	19.00
10	18.65	18.75	19.90	20.20	22.80	25.70	23.50	22.20	21.45	20.90	19.60	19.00
11	18.60	18.70	20.00	20.05	22.90	25.50	23.40	22.20	21.10	20.60	19.60	18.90
12	18.51	18.70	20.00	20.00	22.65	25.30	23.15	21.95	21.00	20.70	19.65	18.90
13	18.47	18.75	20.40	20.00	22.65	24.90	23.00	22.10	20.95	21.40	19.65	18.85
14	18.55	18.75	20.55	19.95	22.50	24.70	23.00	21.95	20.90	21.85	19.65	18.85
15	18.64	18.75	20.25	19.90	22.40	24.70	23.05	21.95	20.90	22.30	19.65	18.80
16	18.70	18.75	19.95	19.95	22.60	24.70	22.90	21.95	20.60	22.80	19.60	18.80
17	18.70	18.85	19.90	19.90	22.70	24.80	22.85	22.00	20.50	22.35	19.50	18.85
18	18.70	18.95	19.85	19.95	22.70	24.55	22.85	21.75	20.50	22.00	19.50	19.05
19	18.60	19.00	19.85	20.15	22.90	24.80	22.75	21.40	20.30	21.15	19.50	19.10
20	18.70	19.05	19.85	20.30	23.25	25.10	22.55	21.50	20.25	21.00	19.50	19.00
21	18.75	19.10	19.85	20.25	23.60	25.30	22.50	21.30	20.10	20.75	19.40	18.85
22	18.75	19.20	19.80	20.30	23.90	25.40	22.40	21.30	20.10	20.60	19.30	18.70
23	18.75	19.15	19.80	20.30	23.95	25.50	22.30	21.30	19.95	20.40	19.30	18.50
24	18.75	19.20	19.90	20.30	24.05	25.70	22.25	23.00	19.85	20.30	19.30	18.40
25	18.75	19.30	19.95	20.50	24.10	25.70	22.10	23.00	19.70	20.20	19.20	18.35
26	18.70	19.35	19.95	21.30	24.40	25.60	22.10	22.25	19.60	20.10	19.10	18.30
27	18.70	19.25	19.95	21.60	24.70	25.65	22.05	22.10	19.55	20.10	19.10	18.30
28	18.75	19.25	20.10	21.80	24.95	25.55	22.25	22.10	19.45	20.10	19.05	18.30
29	18.75	19.30	20.15	22.00	25.00	25.55	22.00	22.40	19.35	19.95	19.05	18.40
30	18.80	.....	20.15	22.00	25.05	25.50	22.00	22.90	19.30	19.95	19.05	18.60
31	18.80	.....	20.05	.....	25.30	.....	22.30	22.25	.....	19.95	.....	18.50

Mean daily discharge, in second-feet, of Colorado River at Yuma, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,960	3,649	4,446	5,990	19,500	46,980	38,930	16,400	18,360	5,660	7,964	5,050
2	3,981	3,685	4,610	5,926	18,140	46,890	35,700	16,090	18,220	5,780	7,900	5,050
3	3,980	3,775	4,627	5,930	18,480	48,020	34,700	16,010	18,250	5,890	7,850	5,079
4	3,980	3,812	4,720	5,930	17,960	49,120	33,180	15,970	18,500	6,014	7,300	4,900
5	4,007	3,775	4,725	6,046	17,040	49,480	32,420	15,550	18,020	7,000	6,955	4,750
6	3,950	3,736	4,730	6,200	17,050	49,920	32,250	15,430	18,290	12,410	6,900	4,997
7	3,820	3,650	4,800	7,033	18,410	51,170	32,190	16,100	18,090	9,700	6,700	5,010
8	3,677	3,565	4,943	7,310	19,800	49,590	30,800	16,250	16,650	9,100	6,544	5,020
9	3,640	3,484	5,240	6,984	20,920	49,180	27,610	17,250	15,620	9,200	6,440	4,850
10	3,550	3,455	5,526	6,660	24,860	47,620	24,700	17,350	14,550	11,190	6,420	4,819
11	3,494	3,342	5,700	6,430	25,820	45,820	23,680	17,600	13,450	10,250	6,400	4,730
12	3,400	3,400	5,720	6,150	23,950	44,310	23,120	17,690	13,050	10,900	6,430	4,730
13	3,350	3,540	8,300	6,100	24,040	42,300	22,760	17,900	12,740	15,600	6,420	4,696
14	3,418	3,525	9,320	5,847	22,850	34,950	22,580	17,190	12,200	19,130	6,420	4,710
15	3,470	3,510	8,141	5,600	22,200	34,260	22,270	16,900	11,770	21,200	6,423	4,680
16	3,512	3,490	7,220	5,823	23,120	34,850	21,550	16,660	9,950	23,200	6,290	4,680
17	3,525	3,620	7,111	5,600	23,800	38,190	21,200	16,770	9,250	21,600	6,020	4,753
18	3,445	3,753	6,700	5,810	23,800	32,850	21,050	15,250	9,100	19,500	5,980	4,800
19	3,407	3,775	6,645	6,323	25,080	38,260	20,200	13,700	8,000	14,580	5,948	4,822
20	3,590	3,794	6,470	6,200	28,950	40,350	18,680	14,200	7,920	13,700	5,910	4,650
21	3,694	3,927	6,300	5,964	32,240	42,250	18,380	13,100	7,720	12,300	5,590	4,400
22	3,640	4,162	5,795	6,180	32,490	43,200	17,450	12,950	7,682	11,480	5,310	4,150
23	3,586	4,130	5,600	6,173	32,520	44,030	16,500	12,960	7,350	10,850	5,269	3,820
24	3,570	4,190	5,810	6,200	34,630	45,440	15,850	23,650	7,100	10,450	5,260	3,641
25	3,550	4,229	5,861	7,640	35,650	44,970	14,950	23,800	6,760	10,060	5,210	3,570
26	3,511	4,310	5,850	13,530	38,150	43,950	15,050	18,740	6,508	9,680	5,156	3,480
27	3,530	4,247	5,820	15,960	40,840	43,710	14,900	18,210	6,290	9,500	5,110	3,480
28	3,595	4,260	6,150	17,600	43,020	44,280	16,040	18,240	5,984	9,300	4,860	3,490
29	3,600	4,310	6,250	19,200	43,480	44,910	14,600	20,200	5,730	8,825	4,790	3,933
30	3,622	.....	6,220	19,400	43,900	43,590	14,580	24,000	5,538	8,550	4,754	4,100
31	3,635	.....	5,971	.....	45,900	.....	16,600	19,350	.....	8,290	.....	3,960

Estimated monthly discharge of Colorado River at Yuma, Ariz., for 1904.[a]

[Drainage area, 225,049 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	4,007	3,350	3,635	223,507	0.016	0.018
February	4,310	3,342	3,797	218,406	.017	.018
March	9,320	4,446	5,978	367,573	.027	.031
April	19,400	5,600	8,058	479,484	.036	.040
May	45,900	17,040	27,697	1,703,022	.123	.142
June	51,170	32,846	43,814	2,607,114	.195	.218
July	38,930	14,580	23,047	1,417,105	.102	.118
August	24,000	12,950	17,144	1,054,143	.076	.088
September	18,500	5,538	11,621	691,497	.052	.058
October	23,200	5,660	11,642	715,839	052	.060
November	7,964	4,754	6,151	366,009	.027	.030
December	5,079	3,480	4,477	275,305	.020	.023
The year	51,170	3,342	13,922	10,119,004	.062	.844

[a] Computed by indirect method devised by W. B. Clapp. See article in Engineering News, April 21, 1904.

Summary of evaporation record at Yuma, Ariz., for 1904.

Month.	Evaporation.	Temperature.						Rain.	Net evaporation.
		Evaporation pan.		Reservoir.		River.			
		7 a. m.	6 p. m.	7 a. m.	6 p. m.	7 a. m.	6 p. m.		
January	3.60	49.4	53.3	50.6	54.3	47.9	49.8	0.00	3.60
February	3.90	58.2	62.7	59.7	63.3	56.1	60.0	.00	3.90
March	6.47	63.8	68.8	65.9	69.8	61.8	62.3	.28	6.19
April	9.37	65.7	72.5	68.2	73.3	65.1	69.2	.00	9.37
May	10.01	72.2	77.7	74.1	78.0	70.0	73.8	.07	9.94
June	10.11	79.3	84.0	81.4	84.1	77.2	80.8	.00	10.11
July	10.24	83.6	83.1	85.6	89.4	81.8	82.7	.05	10.19
August	8.56	86.8	91.7	88.9	92.5	85.5	89.6	.69	7.87
September	6.62	80.6	86.5	81.4	86.3	80.2	83.4	.24	6.38
October	7.02	66.5	71.3	86.7	72.0	65.3	68.4	.00	7.02
November	4.41	56.4	60.7	59.2	62.1	54.8	57.7	.00	4.41
December	2.01	49.9	53.2	52.2	54.3	48.2	49.9	.10	1.91
Total	82.32	.....	.....	.....	.....	.....	.....	1.43	80.89
Mean	.....	67.7	72.5	69.7	73.3	66.2	69.0	.....	.....

IMPERIAL CANAL AT CALIFORNIA-MEXICO BOUNDARY LINE.

Imperial canal heads about 10 miles by river below Yuma, Ariz., on the California side. The station is located a half mile from the river and 600 feet below the wooden head gates. It was established October 24, 1903, by W. D. Smith. The vertical gage is located just above the boundary line on the right bank. It is read twice each day by J. S. Carter, the storekeeper. Discharge measurements are made by means of a boat and cable. The initial point for soundings is a charred post at the southeast corner of the corral, about 150 feet west of the right bank. The channel is straight for 600 feet above and 300 feet below the cable and has a width of 70 feet. The velocity is moderate. There is but one channel at all stages, but when the gage at Yuma reads about 26 feet the river overflows into the channel below the gaging section. The bed of the canal is composed of silt and sand, free from vegetation, and is very unstable. The right bank is low, and is liable to overflow. The left bank has an elevation of 6 feet above high water. Bench mark No. 1 is a standard United States Geological Survey iron bench-mark post. It is located near monument 207 of the United States and Mexico boundary line, on a hill about half a mile west of the gaging station. Its elevation is 52.41 feet above the zero of the gage and 155 feet above sea level. Bench mark No. 2 is a nail in a tree on the right bank. Its elevation is 15.20 feet above the zero of the gage. Bench mark No. 3 is a nail in a post near the ground on the right bank near the corral. Its elevation is 14.90 feet above the zero of the gage.

On October 6, 1904, a new heading was opened on Mexican territory 4 miles below the original station for the diversion of additional water from the Colorado River. Measurements were made in the canal below this heading in order to obtain the total diversion.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Imperial canal at California-Mexico boundary line, head of canal (old gaging station), in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 1	W. D. Smith	8.60	455
January 15	do	8.30	410
January 27	do	8.30	408
February 12	do	8.30	438
February 26	do	8.82	551
March 16	do	10.16	780
Do	do	10.14	751
April 6	do	9.80	704
April 20	do	10.00	725
May 8	do	12.75	1,377
May 24	do	12.20	1,331
June 4	do	10.80	1,011
June 10	do	14.10	2,097
June 16	do	13.95	1,776
August 3	do	13.40	1,646
August 9	S. M. Smith	13.60	1,626
August 17	W. D. Smith	13.35	1,752
August 27	do	13.30	1,679
September 3	S. M. Smith	13.30	1,691
September 10	do	12.50	1,642
September 17	do	12.00	1,271
September 24	W. D. Smith	11.10	868
October 1	do	10.90	762

Mean daily gage height, in feet, of Imperial canal at California-Mexico boundary line, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	8.60	8.50	8.90	9.60	12.85	11.05	14.70	13.60	13.30	10.90
2	8.60	8.50	9.00	9.60	12.70	11.00	14.70	13.50	13.20	10.90
3	8.55	8.50	9.00	9.60	12.70	11.00	14.65	13.40	13.20	10.85
4	8.50	8.50	9.05	9.60	12.60	10.95	14.60	13.35	13.55	10.85
5	8.55	8.50	9.10	9.60	12.30	10.80	14.55	13.10	13.10	12.70
6	8.50	8.45	9.05	9.75	12.25	11.30	(a)	13.00	13.45	12.10
7	8.50	8.40	9.05	9.95	12.60	11.80	(a)	13.40	13.55	.....
8	8.50	8.35	9.10	10.15	12.85	13.10	(a)	13.20	13.20	.....
9	8.45	8.30	9.20	10.00	13.00	13.80	(a)	13.70	12.95	.....
10	8.40	8.20	9.30	10.00	13.35	14.00	(a)	13.60	12.55	12.60
11	8.35	8.35	9.45	9.90	13.50	13.95	(a)	13.65	12.10	.....
12	8.30	8.35	9.55	9.90	13.00	14.10	(a)	13.45	12.05	.....
13	8.20	8.35	9.95	9.80	12.70	a 14.20	(a)	13.45	12.10	.....
14	b 8.25	8.40	10.70	9.85	12.00	14.30	(a)	13.40	12.05	.....
15	b 8.25	8.40	10.50	9.90	11.90	14.10	(a)	13.20	12.10	14.15
16	b 8.25	8.40	10.20	9.90	12.15	14.00	(a)	13.30	11.90	(c)
17	b 8.25	8.50	10.05	9.95	12.30	14.05	(a)	13.25	11.95	.....
18	8.30	8.60	9.95	9.80	12.45	14.10	(a)	12.85	11.80	.....
19	8.30	8.60	9.85	9.85	12.70	14.25	(a)	12.70	11.65	.....
20	8.30	8.60	9.80	10.00	12.70	14.45	(a)	12.70	11.55	.....
21	8.40	8.60	9.60	10.10	12.55	14.60	(a)	12.60	11.30	.....
22	8.40	8.70	9.60	10.10	12.25	14.60	(a)	12.55	11.20	.....
23	8.40	8.70	9.50	10.15	12.20	14.60	(a)	12.50	11.20	.....
24	8.45	8.70	9.50	10.10	12.20	14.60	(a)	13.85	11.20	.....
25	8.35	8.70	9.60	10.20	12.15	14.60	(a)	14.10	11.15	.....
26	8.35	8.80	9.60	11.85	11.80	14.70	(a)	13.50	11.15	.....
27	8.30	8.80	9.65	12.50	11.00	14.75	13.10	13.20	11.20	.....
28	8.40	8.80	9.65	12.80	11.15	14.70	13.05	13.30	11.10	.....
29	8.40	8.80	9.65	12.80	11.15	14.70	13.00	13.55	11.05	.....
30	8.40	.....	9.70	12.80	11.00	14.70	13.40	14.10	10.90	.....
31	8.40	.....	9.80	.....	10.50	.....	13.55	13.50	.....	.....

a Gage destroyed; replaced July 27. b Estimated. c Station discontinued.

Discharge measurements of Imperial canal at heading in Mexico 4 miles below the International boundary line (new gaging station), in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
October 7	W. D. Smith	10.60	1,213
October 15	do	12.75	1,976
October 21	do	10.60	1,356
October 28	do	9.35	1,016
November 4	do	9.30	898
November 11	do	9.20	937
November 18	do	8.95	954
November 25	do	8.85	886
December 2	do	8.60	826
December 9	do	8.85	879
December 20	do	8.90	899
December 28	do	8.00	607

IMPERIAL VALLEY CANALS.

In July, 1904, stations were established on all canals entering the Imperial Valley as follows: Holt canal, Hemlock canal, Alamo channel, Alamitos canal, Main canal, and Boundary canal. These stations are located on United States territory, and in each case near the California-Mexico boundary line. Discharge measurements are made from foot bridges constructed at each station. The gages are vertical rods fastened to 4 by 4 inch timbers substantially embedded in the ground. Automatic water-stage registers, from which the daily gage height record is compiled, were placed at the first five stations mentioned above. These canals enter the valley east of Calexico, Cal. In October a canal, known as canal No. 6, was completed, which enters the valley west of Calexico, Cal. A station was constructed on this canal in November, and weekly discharge measurements are being made. A large quantity of waste water was discharging from the Imperial Valley below all irrigated lands, into the Salton basin. To determine this waste discharge measurements were made on New River at Brawley, on Alamo channel at Rockwood, and on canal No. 5 at Bernice.

The observations at these stations during 1904 were made under the direction of W. B. Clapp, district hydrographer.

Discharge measurements of Holt canal near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 14	W. V. Hardy	2.02	62.0
July 23	do	1.79	53.6
July 26	do	1.75	48.4
July 29	do	1.72	44.0
August 2	do	1.70	43.0
August 5	do	1.70	41.8
August 10	do	1.88	50.0
August 17	do	2.03	59.0
August 23	do	1.96	56.0
August 26	do	1.97	56.0
September 3	W. V. Hardy and E. C. LaRue	2.03	60.0
September 10	do	2.14	61.0
September 18	do	1.63	37.0
September 24	S. M. Smith	1.60	36.0
September 27	do	1.55	33.0
October 1	do	1.90	49.0
October 5	do	1.73	41.0
October 8	do	2.03	56.0
October 15	do	1.97	48.0
October 22	do	1.98	47.0
October 29	do	1.61	30.0
November 4	do	1.62	36.3
November 11	W. V. Hardy and S. M. Smith	1.95	54.0
November 18	W. V. Hardy	1.92	50.0
November 25	do	1.72	40.0
December 2	do	1.52	32.0
December 8	do	1.65	37.0
December 15	do	1.46	27.0
December 22	do	1.58	32.0

Mean daily gage height, in feet, of Holt canal near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.85	2.00	1.90	1.60	1.60
2	.....	1.70	2.10	1.80	1.55	1.55
3	.....	1.70	2.00	1.80	1.55	1.50
4	.....	1.70	2.00	1.80	1.60	1.55
5	.....	1.70	2.00	1.75	1.70	1.60
6	.....	1.65	1.90	1.70	1.80	1.75
7	.....	1.60	1.90	1.80	1.65	1.65
8	.....	1.80	2.10	2.00	2.15	1.65
9	.....	1.85	2.10	2.00	2.15	1.60
10	.....	1.90	2.15	1.85	2.05	1.60
11	.....	1.90	2.15	1.80	2.00	1.65
12	.....	1.90	2.10	1.85	1.90	1.65
13	.....	1.95	1.90	1.90	1.90	1.65
14	.....	1.95	1.70	1.85	1.90	1.60
15	.....	2.00	1.65	1.80	1.85	1.50
16	.....	2.00	1.60	1.90	1.85	1.50
17	.....	2.05	1.55	1.90	1.90	1.45
18	.....	2.05	1.60	1.95	1.90	1.50
19	.....	2.05	1.60	1.95	1.90	1.50
20	.....	(2.05)	1.60	1.95	1.90	1.45
21	.....	(2.05)	1.65	2.00	1.85	1.55
22	1.80	(2.00)	1.55	1.95	1.85	1.55
23	1.80	1.95	1.55	1.85	1.80	1.45
24	1.75	(1.95)	1.55	1.75	1.75	1.25
25	1.70	(1.95)	1.55	1.60	1.75	1.20
26	1.75	1.95	1.50	1.65	1.75	1.05
27	1.80	2.00	1.55	1.70	1.75	1.10
28	1.75	2.05	1.50	1.65	1.70	1.05
29	1.70	2.00	1.50	1.60	1.70	(1.05)
30	1.35	1.90	1.70	1.60	1.65	(1.05)
31	1.90	2.00	.....	1.60	.....	(1.05)

NOTE.—Gage heights in parenthesis are estimated.

Discharge measurements of Hemlock canal near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 23	W. V. Hardy	0.95	4.4
July 26	do	1.15	6.4
July 29	do	1.14	6.0
August 2	do	.92	3.6
August 5	do	1.20	7.3
August 10	do	1.00	4.4
August 17	do	1.08	5.7
August 23	do	1.03	5.0
August 26	do	1.02	4.9
September 3	W. V. Hardy and E. C. LaRue	1.02	4.3
September 10	do	1.07	4.6
September 18	do	1.44	11.5
September 24	S. M. Smith	1.10	3.9
September 27	do	1.10	4.5
October 1	do	1.79	14.5
October 5	do	1.15	5.4
October 8	do	1.31	8.2
October 15	do	1.45	8.8
October 22	do	1.50	10.6
October 29	do	.98	3.1
November 4	do	1.13	6.4
November 11	W. V. Hardy and S. M. Smith	1.29	8.0
November 18	W. V. Hardy	1.31	8.2
November 25	do	1.28	8.0
December 2	do	1.39	9.5
December 8	do	1.13	6.3
December 15	do	1.04	3.3
December 22	do	.88	1.8

Mean daily gage height, in feet, of Hemlock canal near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.95	0.95	1.70	1.05	1.20
2	.....	.90	.95	1.50	1.10	1.40
3	.....	.95	1.00	1.40	1.15	1.40
4	.....	1.10	1.05	1.35	1.15	1.40
5	.....	1.20	1.05	1.15	1.20	1.30
6	.....	1.30	1.05	1.05	1.25	.95
7	.....	(a)	1.05	1.05	1.35	1.15
8	.....	(a)	1.05	1.15	1.40	1.15
9	.....	.90	1.05	.85	1.35	1.10
10	.....	1.00	1.10	.80	1.30	1.10
11	.....	1.00	1.10	.75	1.30	1.10
12	.....	.80	1.05	.65	1.30	1.10
13	.....	.90	1.05	.95	1.30	1.10
14	.....	1.05	1.00	1.30	1.30	1.10
15	.....	1.05	1.05	1.45	1.35	1.00
16	.....	1.05	1.10	1.45	1.45	1.00
17	.....	1.10	1.05	1.45	1.45	.95
18	.....	1.05	1.20	1.45	1.35	.95
19	.....	1.10	1.65	1.45	1.30	.90
20	.....	(1.05)	1.35	1.50	1.30	.90
21	.....	(1.05)	1.10	1.50	1.30	.90
22	1.00	(1.05)	1.00	1.50	1.30	.90
23	.95	1.05	1.00	1.45	1.30	.85
24	1.00	(1.05)	1.00	1.35	1.30	.80
25	1.05	(1.00)	1.05	1.25	1.30	.80
26	1.15	1.00	1.10	1.15	1.30	.65
27	1.15	(1.05)	1.25	1.05	1.30	.60
28	.75	(1.05)	1.45	1.00	1.30	.75
29	1.15	(1.20)	1.35	1.00	1.25	(.75)
30	1.15	(1.25)	1.35	1.05	1.20	(.75)
31	1.00	(1.05)	.....	1.05	.....	(.75)

a Dry.

NOTE.—Gage heights in parentheses are estimated.

Discharge measurements of Alamo channel near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 14	W. V. Hardy	3.20	144
July 23	do	2.80	115
July 26	do	3.09	138
July 29	do	3.51	177
August 2	do	1.63	39
August 5	do	1.61	36.5
August 10	do	3.38	163
August 17	do	3.82	219
August 23	do	3.67	200
August 26	do	3.68	197
September 3	W. V. Hardy and E. C. LaRue	4.00	239
September 10	do	4.00	256
September 18	do	2.95	136
September 24	S. M. Smith	2.77	124
September 27	do	2.80	135
October 1	do	3.79	240
October 5	do	2.65	123
October 8	do	3.55	205
October 15	do	3.40	182
October 22	do	3.82	228
October 29	do	3.05	157
November 4	do	2.97	146
November 11	W. V. Hardy and S. M. Smith	3.04	152
November 18	W. V. Hardy	2.43	97
November 25	do	2.22	86
December 2	do	2.14	80
December 8	do	2.56	107
December 15	do	2.55	111
December 22	do	2.32	80

Mean daily gage height, in feet, of Alamo channel near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.80	(3.90)	3.75	2.95	2.10
2	.....	1.65	(3.90)	3.35	2.95	2.15
3	.....	1.65	4.00	3.00	2.95	2.15
4	.....	1.60	4.00	(2.70)	3.00	2.20
5	.....	1.60	4.00	2.65	2.70	2.30
6	.....	1.80	4.00	3.55	2.50	2.35
7	.....	2.50	4.00	2.75	2.50	2.55
8	.....	2.65	4.00	3.25	(3.00)	2.55
9	.....	2.85	4.00	3.50	(3.00)	2.55
10	.....	3.40	4.00	3.45	(3.00)	2.60
11	.....	3.60	4.00	3.40	3.00	2.60
12	.....	3.60	3.95	3.40	2.75	2.60
13	.....	3.50	3.65	3.40	2.50	2.60
14	.....	3.65	3.35	3.35	(2.40)	2.55
15	.....	3.65	(3.00)	3.40	(2.40)	2.55
16	.....	3.75	(2.90)	3.45	(2.40)	(2.55)
17	.....	3.80	(2.90)	3.40	(2.40)	(2.55)
18	.....	3.80	2.90	3.50	2.40	(2.50)
19	.....	3.80	2.90	3.75	2.40	(2.50)
20	.....	3.80	2.90	3.80	3.40	(2.40)
21	.....	3.80	2.80	3.85	2.35	(2.35)
22	3.25	3.80	2.70	3.80	2.30	2.30
23	2.80	3.65	2.75	3.70	2.25	2.15
24	2.90	3.65	2.75	3.25	2.25	2.00
25	2.95	3.70	2.80	3.20	2.20	(2.00)
26	3.10	3.70	2.75	3.25	2.25	(2.00)
27	3.30	3.80	2.80	3.15	2.25	(1.90)
28	3.40	3.80	2.75	3.05	2.20	(1.80)
29	3.50	3.80	2.95	3.00	2.15	1.75
30	3.60	3.80	3.40	3.00	2.10	(1.75)
31	3.80	3.80	.....	2.95	.....	(1.75)

NOTE.—Gage heights in parenthesis are estimated.

Discharge measurements of Alamitos canal near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 14	W. V. Hardy	1.40	26.6
July 23	do	1.48	24.3
July 26	do	1.30	18.4
July 29	do	1.50	26.3
August 2	do	1.08	8.2
August 5	do	1.04	13.3
August 10	do	.81	3.0
August 17	do	1.20	17.7
August 23	do	1.17	17.4
August 26	do	1.13	15.6
September 3	do	1.10	16.3
September 10	do	1.15	21.0
September 18	do	1.39	31.0
September 24	S. M. Smith	.87	8.3
September 27	do	1.02	13.7
October 1	do	1.10	8.4
October 5	do	1.19	18.7
October 8	do	1.54	36.0
October 15	do	1.50	35.0
October 22	do	1.30	26.0
October 29	do	1.24	25.0
November 4	do	1.21	23.0
November 11	S. M. Smith and W. V. Hardy	1.37	30.0
November 18	W. V. Hardy	1.48	35.0
November 25	do	1.48	26.0
December 2	do	1.34	22.0
December 8	do	1.41	25.0
December 15	do	1.43	26.0
December 22	do	1.46	29.0

Mean daily gage height, in feet, of Alamitos canal near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.00	(1.10)	1.10	1.25	1.35
2	.....	1.10	(1.10)	.65	1.25	1.35
3	.....	1.10	1.10	.90	1.25	1.35
4	.....	1.05	1.05	1.15	1.25	1.35
5	.....	1.05	1.10	1.25	1.30	1.35
6	.....	1.00	1.10	1.30	1.35	1.40
7	.....	1.00	(1.10)	1.40	1.25	1.40
8	.....	.90	1.15	1.45	1.20	1.40
9	.....	1.00	1.15	1.35	1.25	1.50
10	.....	.80	1.15	1.35	1.30	1.60
11	.....	.90	1.15	1.35	1.35	1.45
12	.....	.85	1.20	1.35	1.45	1.40
13	.....	.95	1.15	1.40	1.45	1.45
14	.....	1.00	1.15	1.45	1.45	1.45
15	.....	1.10	1.10	1.50	1.45	1.45
16	.....	1.15	1.15	1.55	1.45	1.45
17	.....	1.20	1.25	1.10	1.45	1.45
18	.....	1.20	1.40	.90	1.50	1.45
19	.....	1.20	1.30	.80	1.45	1.45
20	.....	(1.20)	1.25	1.15	(a)	1.50
21	.....	1.15	1.15	1.35	(a)	1.50
22	1.40	(1.10)	1.10	1.30	1.35	1.45
23	1.50	1.10	1.00	1.30	1.40	1.40
24	1.40	(1.05)	.95	1.25	1.40	1.35
25	1.35	(1.05)	1.10	1.25	1.40	1.25
26	1.30	1.05	1.05	1.25	1.40	1.20
27	1.35	1.05	1.05	1.25	1.40	1.30
28	1.40	(1.05)	1.10	1.25	1.40	1.40
29	1.50	(1.05)	1.15	1.25	1.40	(1.40)
30	1.50	(1.00)	1.00	1.25	1.40	(1.40)
31	1.65	(1.00)	.....	1.25	.....	(1.40)

a Dry.

NOTE.—Gage heights in parenthesis are estimated.

Discharge measurements of Imperial canal (main) near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 14	W. V. Hardy	4.60	615
July 21	do	4.60	642
July 23	do	4.53	625
July 26	do	4.32	598
July 29	do	4.03	519
August 2	do	4.73	652
August 5	do	4.83	677
August 10	do	4.16	556
August 17	do	4.72	644
August 23	do	4.74	669
August 26	do	4.76	696
September 3	do	4.93	717
September 10	do	4.91	682
September 18	do	4.62	662
September 24	do	4.27	573
September 27	S. M. Smith	4.10	560
October 1	do	3.11	249
October 5	do	3.97	474
October 8	do	4.13	548
October 15	do	4.59	642
October 22	do	4.70	639
October 29	do	4.63	656
November 4	S. M. Smith and W. V. Hardy	4.45	598
November 11	do	4.41	601
November 18	W. V. Hardy	4.62	620
November 25	do	4.54	602
December 2	do	4.48	586
December 8	do	4.45	573
December 15	do	4.42	561
December 22	do	4.40	563

Mean daily gage height, in feet, of Imperial canal (main) near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.60	4.85	2.90	4.50	4.50
2	.....	4.75	4.90	3.50	4.50	4.45
3	.....	4.70	4.95	3.80	4.45	4.45
4	.....	4.85	4.90	4.05	4.45	4.45
5	.....	4.80	4.90	4.00	4.50	4.50
6	.....	4.80	4.90	3.95	4.55	4.50
7	.....	4.70	4.90	4.00	4.25	4.45
8	.....	4.55	4.90	4.15	4.25	4.45
9	.....	4.40	4.90	4.25	4.30	4.45
10	.....	4.15	4.90	4.40	4.35	4.40
11	.....	4.20	4.90	4.40	4.40	4.45
12	.....	4.30	4.85	4.40	4.50	4.45
13	.....	4.40	4.80	4.40	4.55	4.45
14	4.60	4.55	4.75	4.55	4.55	4.40
15	4.60	4.65	4.75	4.60	4.55	4.40
16	4.70	4.65	4.75	4.60	4.60	(4.40)
17	4.60	4.70	4.65	4.70	4.60	(4.40)
18	4.60	4.75	4.60	4.75	4.60	(4.40)
19	4.60	4.90	4.60	4.80	4.65	(4.40)
20	4.60	4.75	4.55	4.75	4.70	(4.40)
21	4.60	4.75	4.55	4.70	4.70	(4.40)
22	4.55	4.75	4.50	4.70	4.60	4.40
23	4.55	4.75	4.35	4.65	4.55	4.35
24	4.50	4.75	4.15	4.65	4.55	4.30
25	4.45	4.75	4.10	4.60	4.55	4.20
26	4.30	4.75	4.10	4.65	4.55	4.15
27	4.25	4.80	4.15	4.60	4.60	4.10
28	4.00	4.80	4.15	4.60	4.55	4.00
29	4.00	4.85	4.10	4.65	4.55	(4.00)
30	4.00	4.85	3.30	4.60	4.50	(4.00)
31	4.10	4.85	.....	4.55	.....	(4.00)

NOTE.—Gage heights in parenthesis are estimated.

Discharge measurements of Boundary canal near Calexico, Cal., 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 23	W. V. Hardy	1.20	10.0
July 26	do	1.20	10.0
July 29	do	1.15	9.1
August 2	do	1.65	12.7
August 5	do	1.10	13.0
August 10	do	1.06	10.5
August 17	do	.91	8.3
August 23	do	.85	11.9
August 26	do	1.10	15.6
September 3	W. V. Hardy and E. C. LaRue	1.07	13.2
September 10	do	1.08	12.9
September 18	do	.85	7.5
September 24	S. M. Smith	.99	11.0
September 27	do	.90	9.9
October 1	do	1.00	10.8
October 5	do	1.00	10.0
October 8	do	1.00	9.4
October 15	do	.90	5.9
October 22	do	.10	7.0
October 29	do	.10	7.0
November 4	W. V. Hardy	.78	6.2
November 11	S. M. Smith and W. V. Hardy	.85	6.6
November 18	W. V. Hardy	.82	6.3
November 25	do	.82	6.2
December 2	do	.84	7.0
December 8	do	.65	4.8
December 15	do	.74	5.5
December 22	do	.46	4.0

DUTY OF WATER AND SEEPAGE INVESTIGATIONS MADE AT YUMA, ARIZ.

By W. D. Smith.

The following is a statement of the investigations made on the duty of water for mixed crops under the right and left branches of the Colorado Valley Pumping and Irrigation Company's canal, the duty of water for alfalfa on the Laselle and the Rose ranches, and the seepage loss in the left branch of the Colorado Valley Pumping and Irrigation Company's canal (commonly known as the Ives ditch). All of these lands lie in the upper part of the Yuma Valley, within 6 miles of Yuma, where the pumping plant is located. The results are representative of the Yuma project as a whole, with the exception of the seepage loss, which is believed to be somewhat high.

The climatic conditions have been normal. At the end of the year the zanjero, Mr. S. P. Huss, was asked if he thought the amount of water used was more or less than usual, and he said, "Probably a little less, for the following reasons: Colorado River during the months of August, September, and October, has carried an abnormal amount of fine light mud, due to the heavy discharge of Gila River and other Arizona streams. This was carried through the canals to the lands irrigated, and prevented the water from soaking in readily. In the same way seepage in the ditches was reduced." Mr. Huss states that he observed a marked difference in the amount of time it required to irrigate the same acreage with a given head of water, and that this was not entirely offset by more frequent irrigations. The alfalfa crop appears to have been slightly reduced from this cause. The water costs the irrigators $1 or more per acre-foot, and is, therefore, not wasted; but the scattering location of the farms and the slow velocity of water in the canals and laterals increases the amount lost by seepage. The areas were obtained from the best available sources. The Laselle and Rose ranches were surveyed by the writer.

Four measuring flumes were used, on which nilometer records were kept. Weir measurements would have been unsatisfactory on account of the large amount of sediment carried in the water. The rating of these flumes was constantly changing by the steady filling of the canals with silt. This necessitated frequent ratings or single meter measurements, and at the end of the year, or just before the cleaning of the canal of silt, tables were constructed for periods of from two weeks to two or three months, according to conditions.

Another serious difficulty was the light grade of the canals and the fact that they were discharging nearly their full capacity. This made it almost impossible to locate the flumes where the rating would not be affected by check gates in the canal. In the case of flumes Nos. 2 and 4 this might have been overcome by locating them above the company's weirs, but the advantages would have been offset by the fact that here

the canals are more often cleaned of silt. The flumes were rated with the check gates removed and with them in place, designated as "rating *a*" and "rating *b*," respectively. This would not have been a complete success without the hearty cooperation of the zanjero, Mr. S. P. Huss, in operating the check gates and keeping a record of the same when requested; also the cooperation of Mr. J. M. Boxley and Mr. John Lamar, managers of the Laselle and Rose ranches, respectively.

By the kindness of the engineer, Mr. H. Alexander, another check was obtained on the "*a*" and "*b*" ratings, and on the clock records as a whole. Mr. Alexander kept an accurate record for the whole year of the number of hours the pump was in operation each day, and the number of irrigating heads pumped. An irrigating head is about 12 second-feet.

Flume No. 4 is the property of the Agricultural Experiment Station at Tucson, Ariz. The nilometer on this flume is of French make. The other three were manufactured by Julian P. Friez, of Baltimore, Md. The French machine gave much better results than the latter. In carrying out this work, no impossible degree of accuracy has been attemped; but no pains have been spared to make the results absolutely reliable and reasonably accurate.

Monthly duty of water of right branch of Colorado Valley Pumping and Irrigation Company's canal at Yuma, Ariz.

Month.	Acre-feet.	
	Total.	Per acre.
January	356.0	0.20
February	517.9	.29
March	1,188.5	.66
April	966.2	.54
May	966.3	.54
June	1,284.6	.71
July	1,033.1	.57
August	576.9	.32
September	794.0	.44
October	748.4	.41
November	0.0	.00
December	316.0	.18
Total	8,747.8	4.86

NOTE.—The above includes seepage losses. Crops, mixed. Net area, 1,800 acres.

Monthly duty of water of left branch of Colorado Valley Pumping and Irrigation Company's canal at Yuma, Ariz.

Month.	Acre-feet.	
	Total.	Per acre.
January	100.7	0.22
February	105.5	.23
March	174.5	.39
April	249.6	.55
May	243.8	.54
June	398.0	.88
July	330.8	.73
August	245.8	.55
September	204.0	.45
October	223.9	.50
November	0.0	.00
December	51.5	.12
Total	2,328.1	5.15

NOTE.—The above includes seepage losses. Crops, mixed. Net area, 450 acres.

Monthly duty of water at Laselle ranch, Yuma, Ariz.

Month.	Acre-feet.	
	Total.	Per acre, alfalfa.
January	76.0	0.58
February	48.5	.37
March	64.3	.49
April	66.9	.51
May	109.1	.83
June	53.3	.40
July	140.7	1.07
August	65.3	.49
September	80.9	.61
October	74.9	.57
November	0.0	.00
December	0.0	.00
Total	779.9	5.92

NOTE.—Acreage, net: Alfalfa, 128 acres; wheat, 17 acres; total, 145 acres, which is equivalent to 132 acres of alfalfa.

REMARKS.—The measuring flume is 1,100 feet above the first lateral, so that the loss by seepage after passing the flume and before reaching the ranch is probably about 1 per cent. The soil is very sandy. Most of the alfalfa was cut, but a part was used as pasture. Plenty of water was used, but apparently none was wasted.

Monthly duty of water at Rose ranch, Yuma, Ariz.

Month.	Acre-feet.	
	Total.	Per acre.
January	0.0	0.00
February	0.0	.00
March	13.8	.72
April	15.2	.79
May	10.0	.52
June	14.9	.77
July	12.3	.64
August	8.0	.42
September	8.2	.43
October	13.8	.72
November	0.0	.00
December	2.2	.11
Total	98.4	5.12

NOTE.—Acreage, net: Alfalfa, 19.26 acres.

REMARKS.—7.19 acres of above was wheat and young alfalfa, so irrigated as to make total equivalent to 17.7 acres of old alfalfa. These measurements were made at the ranch and do not include loss by seepage.

Monthly duty of water of Colorado Valley Pumping and Irrigation Company's canal, Yuma, Ariz.

Month.	Acre-feet.		
	Total.	Per acre, gross area.	Per acre, net area.
January	456.7	0.07	0.20
February	623.4	.10	.28
March	1,363.0	.21	.60
April	1,215.0	.19	.54
May	1,210.1	.19	.54
June	1,682.6	.26	.75
July	1,363.9	.21	.60
August	822.7	.13	.37
September	998.0	.15	.44
October	972.2	.15	.43
November	0.0	.00	.00
December	367.5	.06	.16
Total	11,075.9	1.72	4.91

NOTE.—The above includes loss by seepage.

REMARKS.—Mixed crops: Alfalfa, 1,365 acres; grain, 475 acres; corn and sorghum, 245 acres; miscellaneous, 165 acres. Total net area, 2,250 acres; total gross area, 6,500 acres. Number of irrigators, 75.

Cost of pumping, Colorado Valley Pumping and Irrigation Company's Canal, Yuma, Ariz.

Irrigation No.	Month.	Hours pumping.	Acre-feet pumped.	Average lift.	Expense.	Cost per acre-foot.	Cost per foot of raising 1 acre-foot.
1	January	156	457	11.5	$240	$0.53	$0.046
2	February	342	1,173	10.8	564	.48	.044
3	March	230	816	10.5	411	.50	.048
4	April	380	1,216	10.1	607	.50	.050
5	May	183	582	8.7	312	.54	.062
6	May	213	628	7.5	310	.50	.067
7	June	200	623	5.1	271	.43	.084
8	June	220	685	6.4	311	.45	.070
9	June	240	718	6.3	330	.46	.073
10	July	220	706	8.3	362	.51	.061
11	August	300	644	8.9	345	.54	.061
12	August	200	439	8.9	260	.59	.066
13	September	180	480	8.9	340	.71	.080
14	September	175	572	10.7	354	.62	.058
15	October	200	574	9.7	310	.54	.056
16	October	200	456	10.1	302	.66	.065
17	December	180	368	11.4	315	.86	.075
	Total	3,819	11,079	9.05	5,944	.54	.060

NOTE.—The engineer's salary is $100 per month, and this increased the cost per acre-foot in the months when little water was pumped.

Monthly expense.

Month.	Labor.	Wood.	Oil.	Miscellaneous.	Total.
January	$88	$126	$0	$17	$231
February	132	4	170	27	333
March	174	91	320	45	630
April	180	88	312	26	606
May	172	91	305	32	600
June	188	130	340	32	690
July	190	140	328	36	694
August	174	10	352	30	566
September	158	63	280	35	536
October	172	80	288	51	591
November	100	0	0	9	109
December	134	70	80	74	358
Total	1,862	893	2,775	414	5,944

Seepage loss, Ives ditch (Left Branch Colorado Valley Pumping and Irrigation Company's canal) at Yuma, Ariz.

[Distance, 4.26 miles.]

	Per cent.
March 21	10
April 18	17
May 9	14
May 23	18
July 2	19
July 17, a. m	16
July 17, p. m	18
Mean	16

REMARKS.—This is the loss between flumes No. 2 and No. 3. The water travels this distance in four and one-half hours. In each case the register records show a constant head, and meter gagings were made in flume No. 3 (the lower one). In addition to this meter gagings were made in flume No. 2 on May 9, May 23, and July 17, a. m. For the remaining determinations the discharge at flume No. 2 was taken from the rating tables. In each case search was made along the ditch for leaks, and there was a very small loss from this source, which was estimated to be about 2 per cent, making the actual loss by seepage about 14 per cent. The ditch has not been cleaned for several years and is heavily silted, but it passes through a sandy part of the valley.

GREEN RIVER AT GREENRIVER, WYO.

This station was established May 2, 1895. It was located at the pump house at a point about 40 feet below the bridge of the Union Pacific Railroad Company. The gage is a plain staff, graduated to feet and tenths, securely fastened to heavy submerged cribbing on the east bank of the river. Here the water runs in four channels at flood times, but can not possibly overflow beyond, because of the high railroad embankments. The bench mark is a cross on the third step from the bottom of the south end of the east abutment of the railroad bridge. Its elevation was 12.48 feet above the zero of the gage. During the winter of 1903–4 the gage was raised from its original position, and now the bench mark is 12.46 feet above the zero of the gage. As the section under the railroad bridge is poor, discharge measurements are made from the iron highway bridge about one-half mile below. The initial point for soundings is the end of the bridge on the left bank, sounding points being indicated by notches cut in the railing of the bridge on downstream side, and the distance from initial point marked. The channel is straight for about 500 feet above and 300 feet below the station. The current is swift at high water and sluggish when at its lower levels. The stream is confined within the banks and runs in a single channel during low-water periods, when the entire right half of the channel is a bed of clean sand, shifting more or less each year, but as it rises the water extends across the two channels and under the approaches of the bridge. The station was temporarily discontinued during the latter part of 1900 and part of 1901, and no discharge measurements were made in 1903.

The observations at this station during 1904 have been made under the direction of A. J. Parshall, resident hydrographer.

Discharge measurements of Green River at Greenriver, Wyo., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 19	A. J. Parshall	506	1.82	0.90	923
April 8	do	654	2.11	1.60	1,390
April 29	do	868	3.30	2.85	2,864
May 16	do	1,130	3.70	3.35	4,185
May 26	do	2,156	5.87	5.50	12,640
June 4	do	2,006	5.27	5.00	10,570
June 19	do	2,127	5.54	5.30	11,790
June 30	do	1,642	4.58	4.20	7,523
September 26	do	414	1.52	1.05	631
September 26	do	428	1.48	1.05	635
October 21	do	436	1.69	1.17	730

Mean daily gage height, in feet, of Green River at Greenriver, Wyo., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.70	2.98	4.88	4.15	3.12	1.88	1.00
2	1.78	3.00	4.98	4.25	3.10	1.95	1.00
3	1.65	3.08	5.02	4.35	3.02	1.95	.95
4	1.88	3.15	5.00	4.30	2.88	1.95	.98
5	1.75	3.12	4.68	4.15	2.65	1.92	1.02
6	1.90	3.05	4.35	4.10	2.62	1.82	1.08
7	1.98	3.08	4.20	4.10	2.52	1.68	1.15
8	1.65	3.20	4.28	4.02	2.48	1.60	1.20
9	1.40	3.12	4.58	4.00	2.42	1.52	1.20
10	1.38	2.85	4.90	3.92	2.40	1.48	1.25
11	1.50	2.72	4.80	3.82	2.35	1.45	1.28
12	1.92	2.95	4.92	3.72	2.35	1.40	1.32
13	2.35	3.05	5.05	3.70	2.40	1.38	1.38
14	2.40	3.10	4.98	3.68	2.40	1.35	1.32
15	2.62	3.15	4.90	3.62	2.50	1.30	1.25
16	2.70	3.30	5.02	3.50	2.48	1.30	1.20
17	2.35	3.48	5.18	3.42	2.40	1.25	1.18
18	2.30	3.60	5.25	3.38	2.35	1.25	1.15
19	2.28	3.75	5.30	3.30	2.32	1.20	1.15
20	2.38	3.92	5.30	3.22	2.28	1.20	1.15
21	2.58	4.25	5.30	3.20	2.25	1.20	1.15
22	2.80	4.75	5.38	3.15	2.25	1.18	1.15
23	2.55	4.80	5.42	3.10	2.22	1.15	1.15
24	2.38	4.82	5.45	3.10	2.18	1.15	1.15
25	2.30	5.20	5.45	3.22	2.08	1.10	1.15
26	2.12	5.55	5.22	3.30	2.02	1.10	1.12
27	2.30	5.70	4.88	3.35	2.02	1.05	1.10
28	2.52	5.35	4.52	3.30	1.92	1.00	1.10
29	2.80	4.70	4.30	3.22	1.85	1.00	1.10
30	3.15	4.58	4.12	3.18	1.85	1.00	1.10
31	.....	4.72	.....	3.15	1.80	.....	1.10

Rating table for Green River at Greenriver, Wyo., from April 1 to July 15, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	1,110	2.50	2,300	3.70	5,540	4.90	10,100
1.40	1,170	2.60	2,465	3.80	5,920	5.00	10,480
1.50	1,235	2.70	2,645	3.90	6,300	5.10	10,860
1.60	1,305	2.80	2,840	4.00	6,680	5.20	11,240
1.70	1,380	2.90	3,050	4.10	7,060	5.30	11,620
1.80	1,460	3.00	3,280	4.20	7,440	5.40	12,000
1.90	1,550	3.10	3,530	4.30	7,820	5.50	12,380
2.00	1,650	3.20	3,800	4.40	8,200	5.60	12,760
2.10	1,760	3.30	4,095	4.50	8,580	5.70	13,140
2.20	1,880	3.40	4,420	4.60	8,960		
2.30	2,010	3.50	4,780	4.70	9,340		
2.40	2,150	3.60	5,160	4.80	9,720		

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is well defined between gage heights 1.30 feet and 5.50 feet. The table has been extended above gage height 5.50 feet. Above gage height 3.50 feet the rating curve is a tangent, the difference being 380 per tenth.

Rating table for Green River at Greenriver, Wyo., from July 16 to October 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.90	575	1.40	855	2.20	1,730	2.90	2,970
.95	597	1.50	930	2.30	1,870	3.00	3,210
1.00	620	1.60	1,015	2.40	2,020	3.10	3,470
1.05	645	1.70	1,115	2.50	2,180	3.20	3,750
1.10	670	1.80	1,225	2.60	2,355	3.30	4,060
1.15	697	1.90	1,340	2.70	2,545	3.40	4,400
1.20	725	2.00	1,465	2.80	2,750	3.50	4,780
1.30	785	2.10	1,595				

The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements made during 1904, and is well defined.

Estimated monthly discharge of Green River at Greenriver, Wyo., for 1904.

[Drainage area, 7,450 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	3,665	1,155	1,958	116,500	0.263	0.293
May	13,140	2,694	6,131	377,000	.823	.949
June	12,190	7,155	10,180	605,500	1.37	1.53
July	8,010	3,470	5,255	323,100	.705	.813
August	3,540	1,225	2,040	125,400	.274	.316
September	1,402	620	890	52,960	.119	.133
October	838	597	698	42,920	.094	.108
The period				1,643,000		

GREEN RIVER AT JENSEN, UTAH.

This station was established November 7, 1903, by H. S. Reed. It is located about 300 feet below Billings Ferry and about 15 miles from Vernal, Utah. It is 1½ miles below the mouth of Brush Creek and 3 miles above the mouth of Ashley Creek. The gage is a vertical 2 by 5 inch timber 10 feet long, braced to a cottonwood tree about 10 feet from the edge of the river. It is read twice each day by Victor Billings. This station was equipped with a cable and car during 1904, from which the measurement of August 8 was made. Those measurements made previous to August 8 were made from the ferryboat. The initial point for soundings is the first white mark on the cable on the right bank. The channel is straight for 1,000 feet above and below the station. The right bank is high, is composed of gravel, and will not overflow. The left bank is low and sandy and covered with underbrush. The bed of the stream is sandy and shifting. There is but one channel at all stages. Bench mark No. 1 is a 40-penny spike driven into the cottonwood tree to which the gage is attached. Its elevation is 10.66 feet above the zero of the gage. Bench mark No. 2 is a 40-penny spike driven into the southwest corner of Mr. Billings's grain house about 3 feet above the ground. Its elevation is 25.67 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Discharge measurements of Green River at Jensen, Utah, in 1903 and 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per sec.*	*Feet.*	*Second-feet.*
1903.					
November 10	H. S. Reed	654	2.22	2.45	1,453
1904.					
March 31	H. S. Reed	1,273	2.10	3.25	2,679
April 28	do	2,585	3.30	5.78	8,530
May 25	do	5,310	5.14	10.75	27,290
August 8[a]	do	1,670	1.83	3.45	3,059

[a] Made from cable and car.

Mean daily gage height, in feet, of Green River at Jensen, Utah, for 1904.

Day.	Jan.[a]	Feb.[a]	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	4.24	3.32	7.00	10.35	7.25	4.32	2.85	1.63	2.11	1.65
2	.....	.....	4.05	3.42	7.50	10.25	7.18	4.21	2.75	1.62	2.11	1.60
3	.....	.....	3.95	3.55	7.64	10.50	7.15	4.12	2.71	1.64	2.10	1.65
4	.....	.....	3.38	3.90	7.96	10.40	7.10	4.02	3.05	1.65	2.00	1.80
5	.....	.....	3.26	4.30	7.90	10.40	7.08	3.86	3.00	1.63	2.05	1.35
6	.....	.....	3.22	4.45	7.58	10.40	7.02	3.72	2.96	1.68	2.05	.93
7	.....	.....	3.05	4.45	7.82	9.68	7.00	3.58	2.85	2.08	1.99	1.08
8	.....	.....	3.00	4.41	8.02	9.58	7.00	3.48	2.72	1.79	1.83	1.20
9	.....	.....	3.06	4.48	8.35	9.45	6.90	3.40	2.64	1.71	1.65	1.36
10	.....	.....	3.10	4.35	8.02	9.60	6.90	3.36	2.45	1.72	1.63	1.41
11	.....	.....	3.16	4.18	7.65	10.10	6.80	3.33	2.35	1.60	1.58	1.45
12	.....	.....	3.50	4.02	7.68	9.95	6.38	3.30	2.20	1.61	1.55	1.50
13	.....	.....	3.78	4.14	7.89	10.05	6.06	3.26	2.04	1.69	1.48	1.45
14	.....	.....	3.82	4.72	7.96	10.28	5.95	3.18	2.01	1.88	1.60	1.45
15	.....	.....	3.65	5.40	8.10	10.20	5.90	3.08	2.00	2.20	1.50	1.50
16	.....	.....	3.69	5.85	8.52	10.12	5.80	3.10	1.96	2.58	1.60	1.45
17	.....	.....	3.81	6.10	8.68	10.02	5.70	3.40	1.93	2.70	1.60	1.60
18	.....	.....	3.82	6.55	8.98	9.98	5.70	3.40	1.89	2.58	1.55	1.62
19	.....	.....	3.78	6.68	9.01	9.92	5.60	3.45	1.82	2.42	1.55	1.65
20	.....	.....	3.66	6.78	9.12	9.70	5.60	3.50	1.72	2.40	1.50	1.71
21	.....	.....	3.72	6.84	9.60	9.90	5.54	3.50	1.66	2.36	1.50	1.79
22	.....	.....	4.92	6.88	10.00	9.82	5.50	3.45	1.61	2.34	1.55	1.94
23	.....	.....	4.58	6.92	10.30	9.72	5.47	3.42	1.69	2.28	1.65	2.00
24	.....	2.83	4.52	6.95	10.65	9.60	5.41	3.41	1.69	2.19	1.55	1.95
25	.....	3.10	4.35	6.52	10.82	9.50	5.40	3.40	1.68	2.15	1.50	[b] 1.25
26	.....	3.70	4.19	6.15	11.12	9.38	5.40	3.38	1.66	2.10	1.58	1.12
27	.....	4.60	3.83	5.92	11.52	9.15	5.25	3.30	1.62	2.12	1.59	.95
28	.....	4.38	3.22	5.75	11.65	8.85	5.15	3.24	1.60	2.12	1.61	2.60
29	.....	4.31	3.21	5.92	11.80	8.28	4.85	3.20	1.60	2.06	1.60	.....
30	.....	.....	3.29	6.40	11.78	7.38	4.70	3.05	1.60	2.12	1.60	.....
31	.....	.....	3.28	.....	10.65	.....	4.55	2.98	.....	2.13	.....	.....

[a] River frozen over from January 1 to February 23. [b] River frozen over, December 25 to 31.

Rating table for Green River at Jensen, Utah, from November 7, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	400	2.60	1,660	4.30	4,800	7.00	12,380
1.25	430	2.70	1,805	4.40	5,040	7.20	13,060
1.30	460	2.80	1,955	4.50	5,280	7.40	13,740
1.35	495	2.90	2,110	4.60	5,520	7.60	14,440
1.40	530	3.00	2,270	4.70	5,760	7.80	15,160
1.45	565	3.10	2,430	4.80	6,000	8.00	15,890
1.50	600	3.20	2,600	4.90	6,240	8.20	16,650
1.60	670	3.30	2,780	5.00	6,480	8.40	17,410
1.70	740	3.40	2,960	5.20	7,000	8.60	18,200
1.80	820	3.50	3,140	5.40	7,520	8.80	19,000
1.90	900	3.60	3,320	5.60	8,080	9.00	19,800
2.00	980	3.70	3,520	5.80	8,640	9.50	21,900
2.10	1,070	3.80	3,720	6.00	9,200	10.00	24,000
2.20	1,170	3.90	3,920	6.20	9,800	10.50	26,200
2.30	1,280	4.00	4,140	6.40	10,440	11.00	28,400
2.40	1,400	4.10	4,360	6.60	11,080	11.50	30,700
2.50	1,525	4.20	4,580	6.80	11,720		

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1903 and 1904. It is fairly well defined between gage heights 2.45 feet and 10.75 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Green River at Jensen, Utah, for 1903 and 1904.

[Drainage area, 26,620 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
November 7–30	1,564	852	1,292	61,500	0.049	0.044
December	2,834	1,388	1,726	106,100	.065	.075
1904.						
February 24–29	4,992	2,000	3,881	46,180	0.146	0.033
March	6,288	2,270	3,547	218,100	.133	.153
April	12,210	2,816	7,583	451,200	.285	.318
May	32,080	12,380	20,400	1,254,000	.766	.883
June	26,200	13,670	23,000	1,369,000	.864	.964
July	13,230	5,400	9,485	583,200	.356	.410
August	4,848	2,238	3,103	190,800	.117	.135
September	2,350	670	1,214	72,240	.046	.051
October	1,805	670	1,041	64,010	.039	.045
November	1,080	586	745	44,330	.028	.031
December 1–24	980	236	639	30,420	.024	.021
The period				4,323,000		

GREEN RIVER AT OURAY, UTAH.

This station was established March 23, 1904, by H. S. Reed. It is located about 500 feet below the ferry maintained by the Government at Ouray, Utah. The nearest town is Vernal, Utah, 35 miles distant, and the nearest railroad station is Price, Utah, 115 miles distant. A plain staff gage is attached vertically to a 4 by 6 inch timber, which is securely driven into the river bottom and spiked to various portions of a large cottonwood tree that overhangs the right bank. The gage is read twice each day by R. E. Waugh. Discharge measurements are made from the Government ferry cable, which is suspended across the river about 500 feet above the gage. The initial point for soundings is the first white mark on the cable on the right bank of the river. The channel is slightly curved for about 2,000 feet above and straight for 1,200 feet below the station, and there is a good velocity. Both banks are fairly high and timbered. The right bank overflows for a short distance at high stages. The bed of the stream is composed of clean sand, and is shifting. The stream is usually confined to one channel, only changing as sand bars are formed during high water. Bench mark No. 1 is a large nail driven into the inside face of the tree that supports the gage rod. Its elevation is 13.795 feet above the zero of the gage. Bench mark No. 2 is a large nail driven into a blaze on a root of one of a group of large cottonwood trees 150 feet northeast of the gage. Its elevation is 13.51 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Discharge measurements of Green River at Ouray, Utah, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
March 24	H. S. Reed	298	1,914	2.41	2.80	4,610
August 16	do	289	1,319	2.16	1.20	2,852
October 29	do	251	686	2.12	.25	1,457

Mean daily gage height, in feet, of Green River at Ouray, Utah, for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.12	6.00	10.10	6.48	2.45	1.20	0.00	0.25	−0.30
2	.....	1.22	6.40	9.98	6.10	2.25	1.00	.00	.20	− .30
3	.....	1.40	6.38	9.90	5.90	2.08	.95	− .10	.20	− .30
4	.....	1.80	6.70	9.75	5.82	2.00	.85	− .10	.20	− .30
5	.....	2.20	6.70	9.70	5.80	1.92	1.15	− .10	.10	− .40
6	.....	2.20	6.42	9.62	5.75	1.82	1.10	− .10	.10	− .40
7	.....	2.45	6.35	9.40	5.70	1.65	1.00	.00	.00	− .50
8	.....	2.45	6.38	9.18	5.55	1.50	.85	.70	.00	− .50
9	.....	2.40	6.50	9.15	5.38	1.32	.80	.30	.00	− .10
10	.....	2.40	7.00	8.90	5.30	1.25	.75	.10	.00	.00
11	.....	2.12	6.58	9.45	5.20	1.20	.65	.00	.00	.00
12	.....	1.90	6.52	9.80	4.95	1.15	.45	.00	.00	.25
13	.....	2.22	7.00	9.72	4.70	1.22	.30	.10	.00	.40
14	.....	2.78	7.40	9.85	4.42	1.38	.30	.15	.00	a .55
15	.....	3.35	7.65	10.02	4.15	1.20	.26	.30	− .10	a .65
16	.....	3.85	7.90	9.88	3.95	1.22	.15	.40	− .15	a .70
17	.....	4.45	8.05	9.52	3.90	1.25	.00	.60	− .20	a .70
18	.....	4.80	8.18	9.40	3.82	1.32	− .10	.70	− .20	a .70
19	.....	5.15	8.48	9.38	3.65	1.48	− .10	.70	− .20	a .70
20	.....	5.30	8.75	9.32	3.42	1.62	− .10	.65	− .20	a .70
21	.....	5.35	9.02	9.15	3.15	1.68	− .10	.50	− .20	a .70
22	.....	5.55	9.35	9.05	2.92	1.48	− .05	.50	− .20	a .70
23	3.00	5.60	9.92	8.92	2.70	1.32	.00	.50	− .20	a .70
24	2.80	5.82	10.65	8.75	2.50	1.35	.00	.45	− .20	a .70
25	2.40	5.55	10.92	8.60	2.50	1.30	.00	.40	− .20	a .70
26	2.12	5.00	11.18	8.42	2.40	1.20	.00	.30	− .20	a .70
27	1.88	4.60	11.42	8.28	2.38	1.20	.00	.30	.20	a .80
28	1.58	4.40	11.55	7.90	2.45	1.15	.00	.30	− .20	a .90
29	1.28	4.62	11.45	7.45	2.68	1.10	.00	.30	− .30	a .80
30	1.15	5.08	11.10	6.98	2.70	1.40	.00	.30	− .35	a .60
31	1.22	.....	10.52	.....	2.65	1.45	.....	.30	.....	a .50

a Increased gage height due to back water from ice gorge below gaging station.

PINE CREEK NEAR PINEDALE, WYO.

This station was established April 25, 1904, by A. J. Parshall. It is located about one-fourth mile west of Pinedale, Wyo., and is reached from Opal, Wyo., a station on the Oregon Shortline Railroad, by stage from Opal to Cora, thence to Pinedale, a distance of 115 miles. The gage is a vertical 10-inch round timber hewn and planed smooth, graduated to feet and tenths, set 1 foot into the cobblestone bottom of the channel and braced firmly to a pine tree on the left bank. It is read each day by Mrs. Cecilie Petersen. There being no bridge upon the stream, discharge measurements are made by wading near the gage during ordinary discharge and by a boat 2 miles upstream during high water. The channel is straight for about 300 feet above and below the station, and the current is swift. The right bank is low, fringed with timber about 10 feet back from the bank, and is liable to overflow during extreme high water. The left bank is high, fringed with willows, and does not overflow. The bed of the stream is com-

posed of rock and clean gravel, and is permanent. The conditions are only fairly favorable for accuracy. The bench-mark at the gage is a notch cut into a pine tree a few feet south of the gage rod. Its elevation is 5.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. J. Parshall, resident hydrographer.

Discharge measurements of Pine Creek River near Pinedale, Wyo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 26	A. J. Parshall	41	37	1.70	0.50	63
June 1	do	139	231	2.68	2.20	619
June 27	do	153	296	3.45	3.10	1,022
July 23	G. N. Stadin	110	264	2.12	2.10	560
August 16	A. J. Parshall	60	91	2.78	1.20	253
October 27	G. N. Stadin	35	27	1.52	.00	41

Mean daily gage height, in feet, of Pine Creek near Pinedale, Wyo., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	0.60	2.10	3.00	1.80	0.90	0.60
2	.60	2.10	2.90	1.70	.90	.50
3	.60	2.00	2.90	1.60	.90	.50
4	.70	2.00	2.80	1.50	.90	.50
5	.80	2.00	2.80	1.40	.90	.50
6	.80	2.00	2.70	1.30	.80	.40
7	.80	2.00	2.70	1.20	.80	.40
8	.80	2.20	2.60	1.10	.80	.40
9	.80	2.40	2.60	1.00	.80	.30
10	.80	2.40	2.50	1.00	.70	.30
11	.80	2.50	2.40	1.00	.70	.20
12	.80	2.60	2.30	.90	.70	.20
13	.80	2.70	2.20	.90	.70	.20
14	.80	2.90	2.10	1.00	.70	.20
15	.80	3.00	2.00	1.00	.70	.20
16	.90	3.10	2.00	1.00	.70	.20
17	.90	3.20	2.20	1.10	.70	.00
18	1.00	3.30	2.20	1.10	.65	.00
19	1.00	3.40	2.10	1.20	.65	.00
20	1.10	3.50	2.10	1.20	.65	.00
21	1.10	3.60	2.10	1,10	.60	.00
22	1.20	3.60	2.10	1.10	.60	.00
23	1.20	3.70	2.00	1.10	.60	.00
24	1.20	3.60	2.10	1.10	.60	.00
25	1.30	3.50	2.20	1.10	.60	.00
26	2.00	3.40	2.20	1.00	.60	.00
27	2.20	3.00	2.10	1.00	.60	.00
28	2.00	3.10	2.00	1.00	.60	.00
29	2.00	2.90	2.00	1.00	.60	.00
30	2.00	3.10	1.90	1.00	.60	.00
31	2.00	.....	1.90	1.00	.....	.00

Rating table for Pine Creek near Pinedale, Wyo., from April 25 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.00	24	1.00	195	2.00	530	2.90	925
.10	30	1.10	223	2.10	570	3.00	975
.20	39	1.20	253	2.20	610	3.10	1,025
.30	51	1.30	284	2.30	650	3.20	1,075
.40	65	1.40	316	2.40	695	3.30	1,125
.50	81	1.50	348	2.50	740	3.40	1,175
.60	99	1.60	381	2.60	785	3.50	1,230
.70	119	1.70	415	2.70	830	3.60	1,285
.80	142	1.80	450	2.80	875	3.70	1,340
.90	168	1.90	490				

The above table is applicable only for open-channel conditions. It is based upon six discharge measurements made during 1904. It is fairly well defined between gage heights, 1.20 feet and 3.10 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Pine Creek near Pinedale, Wyo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	610	99	240	14,760
June	1,340	530	908	54,030
July	975	490	663	40,770
August	450	168	239	14,700
September	168	99	123	7,319
October	99	24	42.4	2,607
The period				134,200

POLE CREEK AT FAYETTE, WYO.

This station was established April 22, 1904, by A. J. Parshall. It is located about 300 yards west of the post-office at Fayette, Wyo., and is reached by stage from Opal, a station on the Oregon Shortline Railroad, about 125 miles distant, or by a private conveyance from Greenriver, a station on the Union Pacific Railroad, about equally distant. The gage is a vertical 9-inch timber, hewn and planed smooth, graduated to feet and tenths, set in the cobblestone bed of the stream and firmly braced to the left bank. It is read once each day by G. N. Stadin. Discharge measurements are made by wading at low and

ordinary stages, and by means of a boat at high stages of discharge. The measuring section is chosen according to the height of the water, there being no bridges over the stream. The channel is straight for about 50 feet above and 150 feet below the station, and the current is swift. The bed of the channel is very winding, there being no point along the stream where a straight channel can be selected. The right bank is low, covered with brush, and liable to overflow. The slope of the river bed is toward the left bank, which is high, clean, and does not overflow. There is but one channel at low water, and one main channel with a small slough on either side at high water. That on the right side carried no water at any time during 1904. Bench mark No. 1 is the top of a 3-inch stake driven firmly into the ground about 10 feet from the gage, and marked with a copper number "0." Its elevation is 4.47 feet above the zero of the gage. Bench mark No. 2 is the top of a similar stake, about 10 feet from the gage, and marked with a copper number "7." Its elevation is 5.02 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. G. Parshall, resident hydrographer.

Discharge measurements of Pole Creek at Fayette, Wyo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 24	A. J. Parshall	42	46	1.57	1.55	72
May 31	do	78	168	3.72	2.90	625
June 27 [a]	do	80	169	3.61	2.90	610
July 23	G. N. Stadin	76	100	2.05	2.20	205
August 15	A. J. Parshall	42	54	2.17	1.80	117
Do	do	40	48	1.93	1.70	93
October 27	G. N. Stadin	25	26	.62	1.10	16

[a] Measurement from wagon.

Mean daily gage height, in feet, of Pole Creek at Fayette, Wyo., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.50	2.90	2.80	2.20	1.50	1.15
2	1.80	2.90	2.90	2.20	1.45	1.15
3	1.90	2.90	2.90	2.20	1.45	1.15
4	1.90	2.80	2.90	2.10	1.50	1.15
5	1.90	2.70	2.80	2.10	1.50	1.15
6	2.00	2.70	2.80	2.10	1.50	1.15
7	2.10	2.80	2.90	2.10	1.50	1.15
8	2.10	2.80	2.90	2.00	1.50	1.15
9	2.00	2.90	2.80	1.90	1.50	1.15
10	1.90	3.00	2.80	1.90	1.45	1.20
11	1.90	3.10	2.70	1.80	1.45	1.20
12	2.00	3.10	2.60	1.80	1.45	1.20
13	2.00	3.10	2.50	1.80	1.45	1.15
14	2.00	3.20	2.50	1.75	1.45	1.15
15	2.00	3.30	2.50	1.75	1.45	1.15
16	2.10	3.30	2.50	1.70	1.45	1.15
17	2.10	3.30	2.50	1.70	1.40	1.15
18	2.20	3.30	2.50	1.70	1.40	1.15
19	2.25	3.50	2.40	1.70	1.35	1.15
20	2.40	3.50	2.30	1.70	1.35	1.15
21	2.80	3.30	2.20	1.70	1.35	1.15
22	2.90	3.30	2.20	1.65	1.30	1.15
23	3.00	3.30	2.20	1.65	1.25	1.15
24	3.50	3.40	2.30	1.60	1.20	1.15
25	3.50	3.30	2.30	1.60	1.20	1.15
26	3.50	3.20	2.30	1.60	1.20	1.15
27	3.50	3.00	2.30	1.50	1.20	1.10
28	3.20	2.90	2.30	1.55	1.20	1.10
29	3.00	2.80	2.30	1.50	1.20	1.10
30	3.00	2.80	2.30	1.50	1.15	1.10
31	3.00	.....	2.20	1.50	.....	1.10

Rating table for Pole Creek at Fayette, Wyo., from April 22 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.10	16	1.80	113	2.50	325	3.20	915
1.20	27	1.90	133	2.60	380	3.30	1,015
1.30	39	2.00	154	2.70	445	3.40	1,115
1.40	51	2.10	177	2.80	525	3.50	1,215
1.50	64	2.20	205	2.90	615		
1.60	79	2.30	239	3.00	715		
1.70	95	2.40	279	3.10	815		

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904. It is well defined between gage heights 1.10 feet and 2.90 feet. The table has been extended above gage height 2.90 feet.

Estimated monthly discharge of Pole Creek at Fayette, Wyo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	1,215	64	418	25,700
June	1,215	445	799	47,540
July	615	205	371	22,810
August	205	64	116	7,133
September	64	22	48.8	2,904
October	27	16	21.5	1,322
The period				107,400

FALL CREEK NEAR FAYETTE, WYO.

This station was established April 22, 1904, by A. J. Parshall. It is located about 1¼ miles southeast of Fayette, Wyo., and is reached by stage from Opal, a station on the Oregon Short Line Railroad, about 125 miles distant, or by private conveyance from Greenriver, a station on the Union Pacific Railroad, about equally distant. The gage is a vertical 6-inch timber, hewn and planed smooth on one side, graduated to feet and tenths, set into the bed of the stream, and firmly braced to the left bank. It is read once each day by G. N. Stadin. Measurements are made at low and ordinary stages by wading, and at high water by means of a boat, the measuring section being chosen according to the height of the water. The initial point for soundings at the gage is the left bank. The channel is straight for about 40 feet above and 50 feet below the station. The current is sluggish above and swift below the section. Both banks are high and not liable to overflow. The bed of the stream is composed of clean gravel and sand, that portion near the right bank being covered only during high water. There is but one channel at all stages. The conditions are favorable for accuracy. The bench mark is a cross on the highest point of a stone about 1 foot in diameter, planted firmly in the ground 10 feet from the gage and surrounded by smaller stones. Its elevation is 4.63 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. J. Parshall, resident hydrographer.

Discharge measurements of Fall Creek near Fayette, Wyo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 24	A. J. Parshall	18	22	1.14	1.50	25
May 30	do	45	73	3.67	2.50	268
June 27	do	42	59	3.22	2.30	190
July 24	do	35	35	2.00	1.80	70
August 15	do	34	27	.88	1.50	24

Mean daily gage height, in feet, of Fall Creek near Fayette, Wyo., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.50	2.60	2.10	1.80	1.40	1.25
2	1.50	2.50	2.20	1.80	1.35	1.25
3	1.60	2.50	2.20	1.80	1.30	1.25
4	1.65	2.50	2.20	1.80	1.30	1.25
5	1.65	2.40	2.20	1.70	1.30	1.25
6	1.80	2.30	2.25	1.70	1.30	1.25
7	2.00	2.30	2.20	1.60	1.30	1.25
8	2.00	2.40	2.20	1.60	1.30	1.25
9	2.00	2.50	2.20	1.60	1.30	1.25
10	2.00	2.60	2.20	1.50	1.30	1.25
11	2.10	2.70	2.00	1.50	1.25	1.25
12	2.00	2.70	1.90	1.50	1.25	1.25
13	2.00	2.70	1.90	1.50	1.25	1.25
14	2.00	2.70	1.90	1.50	1.25	1.25
15	2.00	2.70	1.80	1.50	1.25	1.25
16	2.15	2.80	1.70	1.50	1.25	1.25
17	2.20	2.90	1.70	1.40	1.25	1.25
18	2.20	2.90	1.70	1.45	1.25	1.25
19	2.20	3.00	1.70	1.45	1.25	1.25
20	2.30	3.00	1.70	1.45	1.25	1.25
21	2.40	3.00	1.70	1.50	1.25	1.25
22	2.50	2.70	1.70	1.50	1.25	1.25
23	2.70	2.70	1.80	1.50	1.25	1.25
24	2.90	2.80	1.80	1.50	1.25	1.25
25	2.90	2.50	1.80	1.50	1.25	1.25
26	3.00	2.40	1.80	1.40	1.25	1.25
27	3.00	2.30	1.80	1.40	1.25	1.25
28	2.50	2.20	1.80	1.40	1.25	1.25
29	2.50	2.10	1.80	1.40	1.25	1.25
30	2.50	2.10	1.80	1.40	1.25	1.25
31	2.60	.....	1.80	1.40	.....	1.25

Rating table for Fall Creek near Fayette, Wyo., from April 24 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.25	7	1.60	36	1.95	101	2.50	263
1.30	9	1.65	43	2.00	113	2.60	300
1.35	12	1.70	51	2.10	138	2.70	340
1.40	16	1.75	60	2.20	165	2.80	385
1.45	20	1.80	70	2.30	195	2.90	430
1.50	25	1.85	80	2.40	228	3.00	480
1.55	30	1.90	90				

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is well defined between gage heights 1.50 feet and 2.50 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Fall Creek near Fayette, Wyo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	480	25	189	11,620
June	480	138	302	17,970
July	180	51	99.3	6,106
August	70	16	31.0	1,906
September	16	7	8.0	476
October	7	7	7.0	430
The period				38,510

BOULDER CREEK NEAR NEWFORK, WYO.

This station was established April 23, 1904, by A. J. Parshall. It is located at the Coolidge ranch, about 3½ miles northeast of Newfork, Wyo., and is reached by private conveyance from Greenriver, a station on the Union Pacific Railroad, about 120 miles distant, or by stage from Opal, a station on the Oregon Short Line Railroad, about equally distant. The gage is a vertical 10-inch timber, hewn and planed smooth on one side, graduated to feet and tenths, firmly set in the bed of the stream, and braced to a tree and stump on the left bank. It is read twice each day by T. J. Coolidge. Discharge measurements are made by wading at ordinary and by means of a boat at high stages, the location of the measuring section depending upon the height of the water. The channel is straight for about 300 feet above and below the station and the current is swift. The right bank is low, covered with brush and spruce trees a few feet back from the bank, and the left bank is high. Neither bank is liable to overflow. The bed of the stream is composed of rock and clean gravel and is

permanent. There is but one channel at all stages. The bench mark is a spike driven into a stump 3 feet from the gage. Its elevation is 4.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. J. Parshall, resident hydrographer.

Discharge measurements of Boulder Creek near Newfork, Wyo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 23	A. J. Parshall	64	68	1.12	0.65	76
May 31[a]	do	90	222	4.68	3.30	1,038
June 26[b]	do	80	320	4.17	3.30	1,335
July 6	G. N. Stadin	88	231	4.09	3.00	945
July 18	do	90	191	2.46	2.10	470
August 14	A. J. Parshall	60	107	1.42	1.00	152
August 20	do	63	107	1.22	.90	131
October 28	G. N. Stadin	40	42	.45	.30	19

[a] Measurement made from wagon.
[b] Measurement made from boat.

Mean daily gage height, in feet, of Boulder Creek near Newfork, Wyo., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	0.90	3.50	3.40	1.48	0.70	0.35
2	.90	3.50	3.30	1.35	.70	.35
3	.90	3.30	2.95	1.30	.70	.35
4	1.00	2.85	2.80	1.28	.70	.35
5	1.00	2.65	2.90	1.20	.68	.30
6	1.00	2.68	3.00	1.12	.65	.30
7	1.00	3.15	2.85	1.10	.62	.30
8	1.00	3.68	2.68	1.08	.60	.30
9	1.00	3.60	2.70	1.05	.60	.30
10	1.00	3.68	2.62	1.02	.55	.30
11	1.00	3.92	2.60	1.00	.50	.30
12	1.00	3.88	2.60	1.00	.50	.30
13	1.10	3.82	2.60	1.00	.50	.30
14	1.18	3.92	2.55	.95	.50	.30
15	1.28	4.28	2.35	.95	.50	.30
16	1.42	4.35	2.20	.95	.45	.30
17	1.58	4.32	2.15	.95	.45	.30
18	1.75	4.25	2.02	.90	.42	.30
19	2.10	4.20	1.90	.90	.40	.30
20	2.55	4.30	1.85	.80	.40	.30
21	2.80	4.40	1.88	.80	.40	.30
22	2.52	4.40	1.90	.80	.40	.30
23	3.05	4.35	1.90	.80	.40	.30
24	3.60	4.05	1.95	.78	.40	.30
25	3.95	3.68	2.08	.75	.35	.30
26	3.70	3.20	2.00	.70	.35	.30
27	3.20	2.98	1.85	.70	.35	.30
28	2.90	2.98	1.75	.70	.35	.30
29	2.90	3.15	1.65	.70	.35	.30
30	3.15	3.35	1.60	.70	.35	.30
31	3.30	.....	1.58	.70	.....	.30

Rating table for Boulder Creek near Newfork, Wyo., from April 23 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.30	19	0.95	137	2.10	470	3.30	1,260
.35	27	1.00	148	2.20	515	3.40	1,355
.40	35	1.10	171	2.30	560	3.50	1,450
.45	43	1.20	195	2.40	610	3.60	1,550
.50	51	1.30	219	2.50	665	3.70	1,650
.55	59	1.40	244	2.60	725	3.80	1,755
.60	67	1.50	271	2.70	790	3.90	1,860
.65	76	1.60	300	2.80	860	4.00	1,970
.70	85	1.70	330	2.90	930	4.10	2,080
.75	95	1.80	360	3.00	1,005	4.20	2,190
.80	105	1.90	395	3.10	1,085	4.30	2,305
.85	115	2.00	430	3.20	1,170	4.40	2,420
.90	126						

The above table is applicable only for open-channel conditions. It is based upon eight discharge measurements made during 1904. It is well defined between gage heights 0.30 foot and 3.00 feet. The table has been extended above 3.30 feet gage height.

Estimated monthly discharge of Boulder Creek near Newfork, Wyo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	1,915	126	563	34,620
June	2,420	758	1,669	99,310
July	1,355	294	625	38,430
August	266	85	139	8,547
September	85	27	50.4	2,999
October	27	19	20.0	1,230
The period				185,100

YAMPA RIVER AT STEAMBOAT SPRINGS, COLO.

This station was established May 3, 1904, by Oro McDermith. It is located on the wooden bridge which crosses the Yampa at the east end of the town of Steamboat Springs, Colo. The gage is a 2 by 4 inch vertical timber 14 feet long, graduated to feet and tenths. It is located on the southwest face of the first pier from the north or right end of the bridge. The gage is read morning and evening by E. J. Cody. Discharge measurements are made from the upper side of the four-span highway bridge to which the gage is attached. The initial point for soundings is the vertical face of the log abutment on the right end of the bridge. The channel is straight for about 50 feet above and for 200 feet below the station. The velocity is very great. The right bank is high, rocky, wooded, and is not subject to overflow. The left bank is low and wooded, but is not liable to overflow. The bed of the stream is composed of bowlders and gravel. There is one channel at all stages, divided by the three piers of the bridge. The piers are diamond shaped, causing eddies. Bench mark No. 1 is a nail driven in end of log of right abutment on the downstream side. It is the second log from the surface of the soil and is immediately above a small sulphur spring. Its elevation is 7.135 feet above the zero of the gage. Bench mark No. 2 is a nail driven in a root of the first tree northeast of the bridge, a cottonwood about 14 inches in diameter. Its elevation is 14.225 feet above the zero of the gage. Bench mark No. 3 was established June 17, 1904. It is a United States Geological Survey standard iron bench-mark post placed 100 feet south of the left end of the bridge. Its elevation is 11.937 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Yampa River at Steamboat Springs, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 3	O. McDermith	98	349	3.22	5.25	1,123
May 19	do	108	491	4.66	6.47	2,289
June 17	do	106	388	3.77	5.78	1,462
June 21	do	98	347	3.26	5.20	1,132
July 25	do	78	169	.78	3.22	132
August 24	do	80	172	.88	3.37	151
August 31	do	80	171	.94	3.38	161

Mean daily gage height, in feet, of Yampa River at Steamboat Springs, Colo., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	6.60	4.90	3.30	3.40	3.30
2	.....	6.42	4.65	3.30	3.45	3.28
3	5.25	6.65	4.35	3.30	3.42	3.30
4	5.18	6.15	4.30	3.30	3.40	3.30
5	5.35	6.05	4.28	3.32	3.38	3.32
6	5.15	5.95	4.30	3.30	3.32	3.30
7	5.55	6.05	4.10	3.30	3.30	3.32
8	5.25	5.98	4.02	3.30	3.30	3.48
9	5.10	5.85	3.85	3.30	3.30	3.50
10	5.12	5.95	3.68	3.30	3.30	3.30
11	5.30	5.85	3.65	3.40	3.30	3.38
12	5.35	5.98	3.50	3.55	3.30	3.40
13	5.55	5.75	3.65	3.32	3.30	3.40
14	5.90	5.95	3.42	3.30	3.30	3.40
15	6.20	6.05	3.38	3.32	3.30	3.38
16	5.95	5.95	3.30	3.30	3.30	3.40
17	6.02	5.90	3.30	3.30	3.30	3.42
18	6.12	5.92	3.30	3.32	3.30	3.38
19	6.45	5.85	3.32	3.30	3.30	3.42
20	6.75	6.00	3.30	3.48	3.30	3.45
21	6.70	5.70	3.42	3.40	3.30	3.45
22	6.80	5.75	3.35	3.40	3.32	3.40
23	6.75	5.55	3.28	3.42	3.30	3.40
24	7.15	5.42	3.42	3.45	3.30	3.40
25	7.40	5.45	3.28	3.45	3.32	3.40
26	7.18	5.15	3.30	3.52	3.45	3.38
27	7.05	4.98	3.32	3.60	3.38	3.40
28	6.80	4.85	3.30	3.55	3.35	3.38
29	7.05	4.82	3.30	3.48	3.30	3.40
30	6.90	5.20	3.30	3.42	3.30	3.42
31	6.75	.....	3.42	3.40	.....	3.40

Rating table for Yampa River at Steamboat Springs, Colo., from May 3 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.20	130	3.90	350	5.00	935	6.10	1,840
3.25	137	4.00	395	5.10	1,000	6.20	1,940
3.30	146	4.10	440	5.20	1,070	6.30	2,045
3.35	157	4.20	485	5.30	1,145	6.40	2,150
3.40	170	4.30	530	5.40	1,220	6.50	2,260
3.45	185	4.40	580	5.50	1,300	6.60	2,370
3.50	200	4.50	630	5.60	1,380	6.80	2,610
3.55	216	4.60	685	5.70	1,465	7.00	2,850
3.60	232	4.70	745	5.80	1,550	7.20	3,110
3.70	268	4.80	805	5.90	1,640	7.40	3,400
3.80	307	4.90	870	6.00	1,740		

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904, and is fairly well defined. The table has been extended above 6.50 feet gage height.

Estimated monthly discharge of Yampa River at Steamboat Springs, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 3-31	3,400	1,000	1,967	113,100
June	2,430	818	1,575	93,720
July	870	142	278	17,090
August	232	146	166	10,210
September	185	146	153	9,104
October	200	142	166	10,210
The period				253,400

YAMPA RIVER NEAR CRAIG, COLO.

This station was established April 30, 1904, by Oro McDermith. It is located on the wagon bridge 1 mile south of Craig, on the road to Meeker, Colo. The gage is a vertical 2 by 4 inch timber 12 feet long, fastened to a pile of the old log abutment at the left end of the bridge. It is graduated to feet and tenths, the numbers being painted on the rod. The gage is read morning and evening by Martin Earley. Discharge measurements are made from the downstream side of the three-span, tubular steel pier bridge to which the gage is attached. The initial point for soundings is the vertical wall of the old log abutment to which the gage is attached. The channel is straight for about 250 feet above and for 300 feet below the station. The current is swift at high, and very sluggish at low stages. Both banks are low and liable to overflow at very high stages, the right through two and the left through one culvert in the road grade. The bed of the stream is composed of gravel, cobblestones, and sand and is permanent. There is one channel at all stages divided by the two piers of the bridge, with the exception of the overflow at extreme high water through the culverts mentioned above. At high water there is always a quantity of driftwood on the piers. Bench mark No. 1 is the top of a bolt marked with a cross on the top of the tubular steel and concrete pier which forms part of the left abutment on the downstream side of the bridge. Its elevation is 14.339 feet above the zero of the gage. Bench mark No. 2 is the top of a bolt marked with a cross on the top of the corresponding pier on the upstream side of the bridge. Its elevation is 14.369 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Yampa River near Craig, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 30	O. McDermith	185	1,080	3.94	5.90	4,256
May 21	do	203	1,358	5.15	7.37	6,995
June 15	do	190	1,154	4.64	6.58	5,347
June 23	do	180	923	3.32	5.25	3,061
July 22	do	133	500	.74	2.53	369
July 27	do	130	489	.62	2.46	304
August 21	do	130	493	.65	2.47	320
September 2	do	133	476	.65	2.42	308

Mean daily gage height, in feet, of Yampa River near Craig, Colo., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	6.15	6.65	4.28	2.45	2.40	2.00
2	6.10	6.28	4.18	2.45	2.40	2.00
3	5.85	6.40	4.12	2.45	2.40	2.00
4	5.65	6.22	4.02	2.45	2.40	2.00
5	5.52	6.65	3.62	2.45	2.38	2.00
6	5.50	5.55	3.72	2.45	2.32	2.00
7	6.00	5.55	3.68	2.45	2.30	2.00
8	5.75	5.78	3.52	2.45	2.30	2.00
9	5.65	6.38	3.50	2.45	2.25	2.00
10	5.58	6.20	3.40	2.42	2.22	2.00
11	5.95	6.65	3.35	2.40	2.18	2.00
12	6.05	6.75	3.25	2.40	2.15	2.05
13	6.25	6.80	3.10	2.40	2.00	2.30
14	6.55	6.70	3.02	2.40	2.00	2.35
15	6.42	6.45	2.95	2.40	2.00	2.40
16	6.35	6.30	2.88	2.32	2.00	2.40
17	6.30	6.08	2.82	2.30	2.00	2.40
18	6.35	5.68	2.80	2.25	2.00	2.40
19	6.55	5.40	2.75	2.60	2.00	2.35
20	7.05	5.72	2.68	2.55	2.00	2.35
21	7.20	5.62	2.45	2.45	2.00	2.35
22	7.25	5.55	2.50	2.45	2.00	2.35
23	7.30	5.38	2.50	2.40	2.00	2.35
24	7.55	5.35	2.50	2.40	2.00	2.35
25	7.62	5.05	2.45	2.40	2.00	2.35
26	7.55	4.92	2.50	2.40	2.00	2.35
27	7.08	4.78	2.48	2.40	2.00	2.30
28	7.10	4.65	2.45	2.40	2.00	2.30
29	7.05	4.45	2.45	2.40	2.00	2.30
30	7.12	4.40	2.45	2.40	2.00	2.30
31	7.00	.....	2.45	2.40	.....	2.30

Rating table for Yampa River near Craig, Colo., from April 30 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	163	3.40	920	4.80	2,470	6.10	4,480
2.10	190	3.50	1,010	4.90	2,610	6.20	4,660
2.20	221	3.60	1,100	5.00	2,750	6.30	4,840
2.30	255	3.70	1,200	5.10	2,890	6.40	5,020
2.40	291	3.80	1,300	5.20	3,030	6.50	5,220
2.50	330	3.90	1,400	5.30	3,175	6.60	5,420
2.60	375	4.00	1,500	5.40	3,325	6.70	5,620
2.70	430	4.10	1,610	5.50	3,475	6.80	5,820
2.80	490	4.20	1,720	5.60	3,630	6.90	6,020
2.90	555	4.30	1,840	5.70	3,790	7.00	6,220
3.00	625	4.40	1,960	5.80	3,955	7.20	6,630
3.10	695	4.50	2,080	5.90	4,125	7.40	7,070
3.20	765	4.60	2,210	6.00	4,300	7.60	7,510
3.30	840	4.70	2,340				

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is well defined between gage heights 5.25 feet and 7.40 feet. Below 5.25 feet the curve is determined by 4 measurements between gage heights 2.42 feet and 2.53 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Yampa River near Craig, Colo., for 1904.

[Drainage area, 1,730 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
May	7,554	3,475	5,281	324,700	3.05	3.52
June	5,820	1,960	4,011	238,700	2.32	2.59
July	1,816	310	731	44,950	.423	.487
August	375	238	299	18,380	.173	.199
September	291	163	201	11,960	.116	.130
October	291	163	230	14,140	.133	.153
The period				652,800		

YAMPA RIVER NEAR MAYBELL, COLO.

This station was established April 17, 1904, by Oro McDermith. It is located at the Thornburgh bridge, 10 miles west of Maybell and 75 miles from Meeker, Colo. A plain staff gage is fastened to the left downstream edge of the central masonry pier. It is read twice each day by Peter Farrell. Discharge measurements are made from the downstream side of the two-span highway bridge to which the gage is attached. The bridge has masonry abutments. The initial point for soundings is the edge of the left abutment. The channel is straight for about 300 feet above and 600 feet below the station. The current is swift, but at low water becomes sluggish above the station. The right bank is high, rocky, clean, and is not subject to overflow. The left bank is low, clean, and everflows during high water. The bed of the stream is composed of gravel and sand, and is shifting. There is but one channel at all stages, broken by the middle pier of the bridge. The bench mark is a United States Geological Survey standard bronze tablet set in the top stone of the right abutment on the downstream side. Its elevation is 10.79 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Yampa River near Maybell, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 17	O. McDermith	215	1,066	3.17	3.70	3,378
June 7	do	217	1,127	3.41	4.15	3,848
July 17	do	195	538	1.36	1.40	729
August 18	do	190	505	.81	.92	410

Mean daily gage height, in feet, of Yampa River near Maybell, Colo., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.00	5.80	2.80	0.80	0.85	0.20	0.50
2	.....	4.50	5.80	2.80	.85	.80	.25	.40
3	.....	4.65	5.25	2.85	.75	.75	.25	.50
4	.....	4.40	5.15	2.80	.85	.70	.30	.30
5	.....	4.15	5.15	2.75	.80	.80	.30	.30
6	.....	4.15	4.70	2.45	.70	.75	.45	.....
7	.....	4.50	4.25	2.10	.60	.65	.35	.....
8	.....	4.10	4.40	2.00	.60	.60	.30	.....
9	.....	3.95	4.25	2.05	.60	.45	.35	.....
10	.....	4.25	4.40	1.90	.65	.50	.35	.....
11	.....	4.25	4.05	1.85	.60	.35	.25	.....
12	.....	4.85	5.10	1.95	.50	.40	.20	.....
13	.....	4.90	5.25	1.80	.50	.30	.40	.....
14	.....	5.15	5.20	1.60	.40	.30	.60	.....
15	.....	4.75	5.20	1.35	.60	.25	.65	.....
16	.....	4.85	5.00	1.35	.65	.40	.70	.....
17	3.70	5.00	4.80	1.35	.55	.45	.65	.....
18	3.85	4.95	4.65	1.30	.50	.40	.65	.....
19	4.05	5.10	4.15	1.20	.60	.45	.75	.....
20	4.50	5.10	4.15	1.05	.65	.45	.80	.....
21	4.65	5.25	4.10	.95	.65	.40	.75	.....
22	5.15	5.30	4.10	.90	.70	.30	.70	.....
23	4.25	5.55	4.55	.75	.80	.35	.65	.....
24	3.85	5.45	4.15	.70	.75	.30	.75	.....
25	3.65	5.60	4.10	.90	.65	.20	.80	.....
26	3.30	5.40	4.10	.85	.80	.25	.80	.....
27	3.65	6.05	4.25	.80	.90	.25	.75	.....
28	4.20	6.50	3.22	.70	.80	.20	.70	.....
29	4.90	5.55	3.05	.80	.90	.20	.60	.....
30	3.95	5.35	2.95	.65	.90	.20	.65	.....
31	.....	5.55	.....	.75	.85	.....	.50	.....

Rating table for Yampa River near Maybell, Colo., from April 17 to December 31, 1904

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.20	195	1.50	800	2.80	2,050	4.00	3,730
.30	220	1.60	870	2.90	2,170	4.20	4,050
.40	250	1.70	950	3.00	2,300	4.40	4,370
.50	285	1.80	1,030	3.10	2,430	4.60	4,690
.60	320	1.90	1,110	3.20	2,560	4.80	5,010
.70	360	2.00	1,200	3.30	2,700	5.00	5,330
.80	405	2.10	1,290	3.40	2,840	5.20	5,650
.90	450	2.20	1,390	3.50	2,980	5.40	5,970
1.00	500	2.30	1,490	3.60	3,120	5.60	6,290
1.10	550	2.40	1,590	3.70	3,270	5.80	6,610
1.20	610	2.50	1,700	3.80	3,420	6.00	6,930
1.30	670	2.60	1,810	3.90	3,570	6.50	7,730
1.40	730	2.70	1,930				

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904. It is not well defined. The table has been extended above gage height 4.15 and below gage height 0.92 feet. Above gage height 3.90 feet the rating curve is a tangent, the difference being 160 per tenth.

Estimated monthly discharge of Yampa River near Maybell, Colo., for 1904.

[Drainage area, 3,670 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April 17–30	5,570	2,700	3,931	109,200	1.07	0.560
May	7,730	3,650	5,232	321,700	1.42	1.64
June	6,610	2,235	4,559	271,300	1.24	1.39
July	2,110	340	942	57,920	.257	.296
August	450	250	360	22,140	.098	.113
September	428	195	271	16,130	.074	.083
October	405	195	301	18,510	.082	.095
The period				816,900		

ELK RIVER NEAR TRULL, COLO.

This station was established May 2, 1904, by Oro McDermith. It is located about 2 miles southeast of Trull post-office, on the stage road between Steamboat Springs and Hayden, Colo. The temporary gage was a 2 by 4 inch by 16-foot timber graduated to feet and tenths, which was placed vertically near the right end of the bridge. It was replaced on June 22, 1904, by a standard chain gage which was installed at the same datum. The chain hangs from a point 25 feet from the initial point for soundings on the downstream side of the bridge. The length of the chain from the end of the weight to the marker is 16.20 feet. The gage is read twice each day by H. W. Laisy. Discharge measurements are made from the downstream side of the single-span bridge to which the gage is attached. The initial point for soundings is the vertical wall of the masonry abutment at the left end of the bridge on the downstream side. The channel is straight for about 100 feet above and for 300 feet below the station. The current is swift at all stages, and at high water exceedingly so. Both banks are low and liable to overflow during extremely high water. The right bank is wooded and the left bank is clean. The bed of the stream is composed of rock and is permanent. There is but one channel at all stages. The bench mark is a United States Geological Survey standard aluminum bench-mark tablet set on the masonry abutment at the right end of the bridge. Its elevation is 15.995 feet above the datum of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Elk River near Trull, Colo., in 1904.

Date.	Hydrographer.	Width	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet*	*Ft. per sec*	*Feet.*	*Sec.-feet.*
May 2	O. McDermith	115	414	4.52	8.40	1,872
May 20	do	115	508	5.13	8.98	2,608
June 16	do	115	411	4.80	8.51	1,972
June 22	do	110	373	4.64	8.20	1,739
July 23	do	95	136	2.24	5.98	304
August 22	do	94	115	1.65	5.61	190
September 1	do	93	106	1.45	5.51	154

Mean daily gage height, in second-feet, of Elk River near Trull, Colo., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	8.42	7.52	5.82	5.55	5.52
2	8.35	8.38	7.50	5.75	5.70	5.40
3	8.28	8.40	7.30	5.70	5.52	5.30
4	8.12	8.12	7.30	5.70	5.42	5.30
5	8.05	7.85	7.18	5.70	5.38	5.25
6	8.08	7.85	7.00	5.65	5.32	5.25
7	8.60	7.95	6.92	5.58	5.30	5.32
8	8.00	8.22	6.90	5.55	5.25	5.40
9	7.98	8.40	6.85	5.50	5.25	5.38
10	8.25	8.22	6.75	5.50	5.25	5.55
11	8.48	8.65	6.72	5.50	5.22	5.50
12	8.50	8.85	6.60	5.82	5.20	5.52
13	8.58	8.82	6.55	5.75	5.18	5.50
14	8.60	8.72	6.42	5.70	5.15	5.52
15	8.58	8.58	6.35	5.70	5.15	5.52
16	8.60	8.52	6.32	5.68	5.18	5.60
17	8.58	8.50	6.28	5.78	5.20	5.55
18	8.72	8.28	6.22	5.95	5.20	5.52
19	8.94	8.20	6.12	5.85	5.20	5.40
20	8.95	8.28	6.05	5.68	5.20	5.48
21	9.32	8.30	6.05	5.65	5.20	5.48
22	8.90	8.25	6.00	5.50	5.22	5.48
23	9.16	8.18	6.00	5.30	5.38	5.45
24	9.60	8.18	5.92	5.32	5.32	5.45
25	9.18	7.90	6.08	5.32	5.25	5.38
26	8.92	7.80	5.90	5.25	5.30	5.38
27	8.62	7.82	5.85	5.28	5.40	5.38
28	8.62	7.72	5.88	5.50	5.38	5.32
29	8.55	7.62	6.15	5.50	5.30	5.35
30	8.70	7.62	6.12	5.45	5.45	5.35
31	8.82	.....	5.95	5.48	.....	5.32

Rating table for Elk River near Trull, Colo., from May 2 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.15	80	6.00	312	7.20	905	8.30	1,810
5.20	88	6.10	350	7.30	975	8.40	1,910
5.25	97	6.20	390	7.40	1,045	8.50	2,010
5.30	107	6.30	430	7.50	1,115	8.60	2,120
5.35	118	6.40	470	7.60	1,190	8.70	2,240
5.40	130	6.50	520	7.70	1,270	8.80	2,365
5.45	143	6.60	570	7.80	1,350	8.90	2,495
5.50	156	6.70	620	7.90	1,430	9.00	2,630
5.60	184	6.80	670	8.00	1,520	9.20	2,910
5.70	213	6.90	725	8.10	1,610	9.40	3,190
5.80	244	7.00	785	8.20	1,710	9.60	3,485
5.90	277	7.10	845				

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904. It is well defined between gage heights 8.20 feet and 9.00 feet, and between gage heights 5.50 feet and 6.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Elk River near Trull, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 2–31	3,485	1,502	2,185	130,000
June	2,430	1,206	1,749	104,100
July	1,129	260	539	33,140
August	294	97	185	11,380
September	213	80	110	6,545
October	184	97	137	8,424
The period				293,600

WILLIAMS RIVER AT HAMILTON, COLO.

This station was established April 29, 1904, by Oro McDermith. It is located at the highway bridge at Hamilton, on the stage road from Meeker to Craig, Colo., and about 17 miles from the latter place. The gage is a 2 by 4 inch by 14 foot timber driven vertically into the bottom of the river with the upper end fastened to the lower side of the bridge. It is read morning and evening by Mrs. Thomas Hamilton. Discharge measurements are made from the lower side of the single-span bridge to which the gage is attached. The initial point for soundings is the vertical log abutment at the left end of the bridge on the downstream side. The channel is straight for about 150 feet above and for 100 feet below the station. The current is swift. The right bank is high, rocky, clean, and is not subject to overflow. The left bank is low and wooded, and does not overflow except during extreme high water. The bed of the stream is composed of rocks and gravel, and is permanent. There is but one channel at all stages. A reef of rocks extends into the stream for about 10 feet on the right bank just above the station. Bench mark No. 1 is a nail driven into the top log at the northeast corner of the left abutment of the bridge. Its elevation is 12.22 feet above the zero of the gage. Bench mark No. 2 is the head of a nail driven into a root on the west side of a small cottonwood tree about 25 feet from the left end of the bridge and just east of the road. Its elevation is 10.08 feet above the zero of the gage. Bench mark No. 3 is a nail driven into the southeast corner of the foundation of the blacksmith shop about 25 feet from the left end of the bridge. Its elevation is 10.08 feet above the zero of the gage. Bench mark No. 4 is a United States Geological Survey standard iron bench mark at the southeast corner of the wagon bridge at Hamilton. Its elevation is 10.77 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Williams River at Hamilton, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec*	*Feet.*	*Sec.-feet.*
April 29	O. McDermith	55	220	5.18	5.80	1,139
May 22	do	55	204	4.89	5.39	998
June 24	do	47	146	3.59	4.40	524
July 22	do	40	79	1.03	2.81	81
August 13	do	40	87	.76	2.78	66
September 3	do	41	92	1.03	2.91	95

Mean daily gage height, in feet, of Williams River at Hamilton, Colo., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	5.38	5.00	3.80	2.85	2.95	2.78
2	.....	5.40	4.95	3.75	2.82	3.12	2.70
3	.....	5.10	5.00	3.75	2.80	2.95	2.68
4	.....	5.15	4.85	3.62	2.75	2.82	2.62
5	.....	4.85	4.60	3.55	2.80	2.75	2.65
6	.....	4.90	4.75	3.55	2.80	2.70	2.65
7	.....	5.32	4.80	3.55	2.72	2.70	2.65
8	.....	5.00	5.05	3.50	2.75	2.70	2.82
9	.....	4.80	5.15	3.48	2.70	2.65	2.80
10	.....	5.00	4.90	3.42	2.70	2.65	2.88
11	.....	5.58	5.25	3.32	2.70	2.65	2.80
12	.....	5.90	5.20	3.22	2.75	2.62	2.70
13	.....	5.90	5.40	3.28	2.78	2.60	2.80
14	.....	5.90	5.25	3.15	2.88	2.60	2.78
15	.....	6.00	5.10	3.10	2.95	2.60	2.78
16	.....	5.55	5.00	2.95	2.72	2.50	2.75
17	.....	5.48	5.00	3.00	2.80	2.52	2.70
18	.....	5.65	4.75	2.88	3.08	2.65	2.70
19	.....	6.10	5.00	2.88	3.12	2.68	2.70
20	.....	6.00	4.90	2.82	2.95	2.65	2.65
21	.....	5.45	4.60	2.85	2.92	2.60	2.80
22	.....	5.35	4.45	2.82	2.90	2.60	2.75
23	.....	5.65	4.45	2.92	2.85	2.72	2.72
24	.....	5.85	4.40	2.98	2.80	2.72	2.70
25	.....	5.55	4.20	2.98	2.80	2.72	2.68
26	.....	5.50	4.12	2.90	2.78	2.70	2.60
27	.....	5.30	3.95	2.85	2.80	2.80	2.68
28	.....	5.35	3.95	2.78	2.88	2.75	2.62
29	5.70	5.35	3.88	2.82	2.98	2.70	2.62
30	5.50	5.35	3.85	3.00	2.85	2.70	2.65
31	.....	5.20	.....	2.82	2.95	.....	2.65

Rating table for Williams River at Hamilton, Colo., from April 29 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.50	21	3.10	143	3.90	360	5.10	820
2.55	30	3.15	155	4.00	390	5.20	870
2.60	39	3.20	167	4.10	420	5.30	920
2.65	49	3.25	179	4.20	450	5.40	970
2.70	59	3.30	192	4.30	485	5.50	1,020
2.75	69	3.35	205	4.40	525	5.60	1,070
2.80	79	3.40	218	4.50	565	5.70	1,130
2.85	89	3.45	232	4.60	605	5.80	1,190
2.90	99	3.50	246	4.70	645	5.90	1,250
2.95	110	3.60	274	4.80	685	6.00	1,310
3.00	121	3.70	302	4.90	725	6.10	1,370
3.05	132	3.80	330	5.00	770		

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is not well defined. The table has been extended above gage height 5.80 feet and below gage height 2.80 feet.

Estimated monthly discharge of Williams River at Hamilton, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	1,370	685	1,003	61,670
June	970	345	667	39,690
July	330	75	166	10,210
August	148	59	87	5,349
September	148	21	60	3,570
October	95	39	61	3,751
The period				126,000

MILK CREEK NEAR AXIAL, COLO.

This station was established April 20, 1904, by Oro McDermith. It is located at the highway bridge about 4 miles below Axial, Colo. The gage is a vertical plain staff gage, graduated by feet and tenths to 10 feet, driven 2 feet into the sandy bed of the stream, the top being nailed to the bridge timbers. It is read once each day by O. M. Hoback. Discharge measurements are made from the lower side of the single-span bridge to which the gage is attached. The initial point for soundings is at the left end of the bridge at the water's edge on the downstream side. The channel is straight for about 75 feet above and 50 feet below the station, and the current is swift. Both banks are high, clean, and do not overflow. The bed of the stream is composed of sand and is shifting. There is but one channel at all stages. There is a sunken log at the right bank, which slightly affects the measurements. Bench mark No. 1 is a nail driven into the east side of a telephone pole 25 feet south of the bridge. It is about 4 inches above the ground, and its elevation is 10.961 feet above the zero of the gage. Bench mark No. 2 is a nail driven into the north side of a 12-inch pile at the northeast corner of the bridge. Its elevation is 10.080 feet above the zero of the gage. Bench mark No. 3, established July 21, 1904, is a United States Geological Survey standard iron bench-mark post, located about 50 feet southeast of the gage rod. Its elevation is 12.334 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Milk Creek near Axial, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 20	O. McDermith	23	74	2.35	5.78	174
May 22	do	20	60	2.22	5.27	133
June 14	do	18	26	1.69	4.00	44
June 24	do	17	16	1.06	3.65	17
July 21	do	8	3.9	.46	3.23	1.8

Mean daily gage height, in feet, of Milk Creek near Axial, Colo., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	6.30	4.40	3.40	3.20	3.50	3.40
2	.....	6.00	4.30	3.40	3.20	3.45	3.35
3	.....	5.80	4.80	3.40	3.20	3.30	3.30
4	.....	5.40	4.70	3.35	3.20	3.25	3.30
5	.....	5.60	4.50	3.30	3.20	3.25	3.20
6	.....	5.60	4.40	3.30	3.20	3.20	3.30
7	.....	6.20	4.40	3.30	3.20	3.20	3.30
8	.....	5.70	4.35	3.30	3.20	3.20	3.40
9	.....	5.40	5.10	3.30	3.20	3.20	3.60
10	.....	5.70	4.60	3.30	3.20	3.20	3.70
11	.....	6.00	4.50	3.30	3.20	3.20	3.60
12	.....	6.20	4.50	3.25	3.20	3.15	3.50
13	.....	6.30	4.45	3.25	3.20	3.15	3.40
14	.....	6.30	4.35	3.25	3.20	3.15	3.40
15	.....	6.25	4.30	3.25	3.42	3.15	3.35
16	.....	6.00	4.00	3.20	3.20	3.15	3.35
17	.....	5.90	3.80	3.25	4.65	3.20	3.35
18	.....	5.70	4.60	3.25	3.60	3.20	3.35
19	.....	6.10	5.40	3.25	3.40	3.25	3.30
20	5.88	5.50	4.00	3.25	3.35	3.25	3.30
21	6.45	5.25	3.80	3.25	3.35	3.20	3.25
22	5.60	5.25	[a] 3.70	3.25	3.35	3.30	3.25
23	5.50	5.20	[a] 3.65	3.25	3.35	3.35	3.30
24	5.30	5.10	[a] 3.60	3.25	3.35	3.40	3.30
25	4.90	5.05	[a] 3.55	3.25	3.35	3.40	3.35
26	5.35	5.00	3.50	3.20	3.30	3.60	3.30
27	5.70	4.95	3.50	3.20	3.30	3.50	3.35
28	6.35	4.85	3.50	3.20	3.30	3.50	3.35
29	6.50	4.75	3.45	3.20	3.30	3.40	3.30
30	6.40	4.60	3.45	3.25	3.30	3.40	3.30
31	.....	4.50	.....	3.25	3.08	.....	3.30

[a] Estimated.

Rating table for Milk Creek near Axial, Colo., from April 20 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.15	1	3.70	23	4.50	76	5.60	159
3.20	2	3.75	26	4.60	83	5.70	167
3.25	3	3.80	29	4.70	90	5.80	175
3.30	4	3.85	32	4.80	97	5.90	183
3.35	6	3.90	35	4.90	104	6.00	191
3.40	8	3.95	38	5.00	111	6.10	200
3.45	10	4.00	41	5.10	119	6.20	209
3.50	12	4.10	48	5.20	127	6.30	218
3.55	14	4.20	55	5.30	135	6.40	227
3.60	17	4.30	62	5.40	143	6.50	236
3.65	20	4.40	69	5.50	151		

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904, and is fairly well defined.

Estimated monthly discharge of Milk Creek near Axial, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 20–30	236	104	178	3,883
May	218	76	157	9,654
June	143	10	55	3,273
July	8	2	3.6	221
August	87	1	6.7	412
September	17	1	4.8	286
October	23	2	6.6	406
The period				18,140

LITTLE SNAKE RIVER NEAR MAYBELL, COLO.

This station was established April 18, 1904, by Oro McDermith. It is located on the wagon bridge on the road to Browns Park, about 30 miles west of Maybell, Colo., and about 90 miles from Meeker, Colo. The gage is a 2 by 4 inch by 12-foot timber, placed vertically against the rock cliff which extends into the river on the left side of the stream. It is read once each day by John M. Karr. Discharge measurements are made from the downstream side of the single-span bridge. The initial point for soundings is the vertical wall of the masonry abutment at the left end of the bridge. The channel is straight for about 200 feet above and for 150 feet below the station. The current is sluggish above and swift below the station, the river breaking into rapids about 100 feet below the bridge. Both banks are high and rocky and are not subject to overflow. The bed of the stream is composed of rock covered with quicksand. A United States Geological Survey standard aluminum bench-mark tablet is placed on the apex of the rocky ledge about 20 feet northeast of the left end of the bridge. Its elevation is 10.98 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Little Snake River near Maybell, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 18	O. McDermith	96	410	2.92	5.20	1,198
June 9	do	103	526	3.40	5.83	1,791
July 18	do	90	74	1.88	1.90	139
August 19	do	49	28	1.39	1.05	39

Mean daily gage height, in second-feet, of Little Snake River near Maybell, Colo., for 1904.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	.....	4.10	1.30	12	5.80	3.20	2.00	23	4.90	1.60	.....
2	.....	4.10	1.20	13	5.90	3.10	1.50	24	4.80	1.60	.....
3	.....	3.80	1.20	14	5.90	3.00	1.50	25	4.70	1.70	.....
4	.....	3.70	1.20	15	5.70	3.00	.....	26	4.60	2.00	.....
5	.....	3.60	1.20	16	5.70	[a]2.50	.....	27	4.50	1.60	.....
6	.....	3.60	1.20	17	5.50	[a]2.40	.....	28	4.40	1.60	.....
7	.....	3.50	1.20	18	5.50	1.90	.....	29	4.30	1.70	.....
8	.....	3.50	1.20	19	5.60	1.80	.....	30	4.20	1.70	.....
9	5.80	3.40	1.20	20	5.40	1.80	.....	31	.....	1.30	.....
10	6.40	3.30	1.10	21	5.40	1.70	.....				
11	6.10	3.30	1.10	22	5.10	1.70	.....				

[a] Estimated.

Rating table for Little Snake River near Maybell, Colo., from April 18 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.10	43	2.50	240	3.90	635	5.20	1,280
1.20	53	2.60	261	4.00	675	5.30	1,340
1.30	63	2.70	283	4.10	715	5.40	1,410
1.40	74	2.80	306	4.20	760	5.50	1,480
1.50	86	2.90	330	4.30	805	5.60	1,550
1.60	99	3.00	355	4.40	850	5.70	1,620
1.70	112	3.10	380	4.50	900	5.80	1,690
1.80	125	3.20	405	4.60	950	5.90	1,760
1.90	139	3.30	435	4.70	1,000	6.00	1,830
2.00	153	3.40	465	4.80	1,050	6.10	1,900
2.10	168	3.50	495	4.90	1,100	6.20	1,980
2.20	184	3.60	530	5.00	1,160	6.30	2,060
2.30	201	3.70	565	5.10	1,220	6.40	2,140
2.40	220	3.80	600				

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904. It is not well defined.

Estimated monthly discharge of Little Snake River near Maybell, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June 9–30	2,140	760	1,370	59,780
July	715	63	306	18,820
August 1–14	153	43	61.1	1,777

ASHLEY CREEK NEAR VERNAL, UTAH.

This stream drains an area directly east of the Uinta basin. The station was established March 15, 1900, by C. T. Prall. The river emerges from its canyon about 7½ miles north of Vernal, Utah. The station is located near this point, at the highway bridge leading by the farm of the gage reader. The station is 1 mile below the mouth of Dry Fork and is above the series of canals by which Vernal Valley is irrigated. The gage is a vertical 1 by 5 inch board, 10 feet long, fastened to overhanging trees on the right bank just above the bridge. It is read twice each day by E. Marett. Discharge measurements are made at high water from the bridge and at ordinary stages by wading. The initial point for soundings is on the right bank. The channel is straight for 200 feet above and below the station. The current is swift. The right bank is high, not liable to overflow, and covered with trees. The left bank is low, covered with underbrush, and is subject to overflow at flood stages, at which time there are two or three channels. The bed of the stream is rough and rocky, and is not subject to change. The bench mark is a large nail, about which are driven three smaller nails, in a stump 50 feet west of the bridge. Its elevation is 7.21 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Discharge measurements of Ashley Creek near Vernal, Utah, 1903–1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.[a]	Discharge.
1903.		*Feet.*	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 8	H. S. Reed		316	5.33	4.50	1,685
August 24	do		41	2.12	1.80	87
September 23	do		41	1.80	1.75	74
November 9	do		34	1.53	1.60	52
1904.						
January 24	H. S. Reed	35	37	1.08	1.60	40
March 30[b]	do	36	30	1.13	1.40	34
April 27	do	38	98	5.20	3.15	510
April 29	do	37	69	3.46	2.50	239
April 29	do	37	73	3.20	2.50	234
May 24	do	42	128	5.67	3.65	726
May 24	do	42	128	5.43	3.65	695
August 6[b]	do	36	35	1.91	1.85	67
August 6[b]	do	36	35	1.60	1.85	56
December 23	do	34	23	1.26	1.40	29

[a] All gage heights refer to new rod established June 8, 1903. [b] Measurement by wading.

NOTE.—Discharge measurements for 1903 prior to June 8 are published in 1903 report.

Mean daily gage height, in feet, of Ashley River near Vernal, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.40	1.40	1.30	1.40	2.60	2.90	2.10	1.90	1.80	1.80	1.80	1.50
2	1.40	1.40	1.30	1.40	2.40	2.95	2.00	1.90	1.80	1.70	1.80	1.50
3	1.40	1.40	1.30	1.40	2.30	3.00	2.00	1.90	1.80	1.70	1.80	1.50
4	1.40	1.40	1.30	1.40	2.35	2.95	2.00	1.85	1.80	1.70	1.80	1.50
5	1.40	1.40	1.30	1.40	2.50	2.90	2.00	1.80	1.80	1.70	1.80	1.50
6	1.40	1.40	1.30	1.40	2.65	3.00	2.00	1.80	1.80	1.70	1.70	1.50
7	1.40	1.40	1.30	1.45	2.55	3.10	2.10	1.80	1.80	1.85	1.70	1.50
8	1.40	1.40	1.30	1.50	2.40	3.30	2.10	1.80	1.80	1.80	1.70	1.50
9	1.40	1.40	1.30	1.55	2.60	3.10	2.10	1.80	1.80	1.80	1.70	1.50
10	1.40	1.80	1.30	2.25	2.75	3.05	2.10	1.80	1.80	1.80	1.70	1.50
11	1.40	1.55	1.30	2.25	3.00	2.95	2.10	1.80	1.80	1.80	1.70	1.50
12	1.40	1.40	1.30	1.90	2.95	2.85	2.10	1.80	1.80	1.80	1.70	1.50
13	1.40	1.40	1.30	1.95	3.35	2.80	2.10	1.80	1.80	1.80	1.60	1.50
14	1.40	1.40	1.30	2.45	3.55	2.80	2.00	1.95	1.80	1.80	1.60	1.50
15	1.40	1.40	1.30	2.75	3.45	2.70	2.00	2.00	1.80	1.80	1.60	1.50
16	1.40	1.40	1.30	2.15	3.55	2.70	2.00	2.00	1.80	1.80	1.60	1.50
17	1.40	1.40	1.30	2.40	3.45	2.65	2.00	2.00	1.80	1.80	1.60	1.50
18	1.40	1.40	1.30	3.20	3.90	2.60	2.00	2.00	1.80	1.80	1.60	1.50
19	1.40	1.40	1.30	2.80	3.75	2.50	2.00	2.05	1.80	1.80	1.60	1.50
20	1.40	1.40	1.45	2.50	3.40	2.50	2.00	2.00	1.80	1.80	1.60	1.50
21	1.40	1.30	1.30	2.35	3.45	2.40	2.00	1.90	1.80	1.80	1.60	1.50
22	1.40	1.30	1.30	2.00	3.45	2.40	2.00	1.90	2.40	1.80	1.60	1.50
23	1.40	1.30	1.30	1.90	4.00	2.40	2.00	1.90	2.00	1.80	1.60	1.40
24	1.40	1.30	1.30	2.10	3.70	2.30	2.05	1.90	2.00	1.80	1.60	1.40
25	1.40	1.30	1.35	2.85	3.65	2.30	1.95	1.90	1.90	1.80	1.60	1.40
26	1.40	1.30	1.30	3.15	3.45	2.30	1.90	1.90	1.90	1.80	1.60	1.60
27	1.40	1.30	1.30	3.20	3.60	2.20	1.90	1.90	1.80	1.80	1.60	1.40
28	1.40	1.30	1.30	2.90	3.25	2.20	1.90	1.90	1.80	1.80	1.60	1.40
29	1.40	1.30	1.55	2.40	3.20	2.15	1.90	1.90	1.80	1.80	1.60	1.40
30	1.40	.....	1.40	2.30	3.10	2.10	1.90	1.90	1.80	1.80	1.50	1.40
31	1.40	.....	1.40	.....	3.00	.....	1.90	1.90	.....	1.80	.....	1.40

Rating table for Ashley Creek near Vernal, Utah, from June 9, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	25	2.20	150	3.00	433	3.80	815
1.40	31	2.30	176	3.10	478	3.90	890
1.50	38	2.40	205	3.20	523	4.00	985
1.60	47	2.50	236	3.30	568	4.10	1,100
1.70	58	2.60	270	3.40	613	4.20	1,235
1.80	71	2.70	307	3.50	658	4.30	1,380
1.90	87	2.80	347	3.60	705	4.40	1,530
2.00	105	2.90	389	3.70	755	4.50	1,685
2.10	126						

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made between the limits of the table. It is well defined between gage heights 1.30 feet and 3.70 feet. Above gage height 3.70 feet the curve is determined by one measurement.

Estimated monthly discharge of Ashley Creek near Vernal, Utah, for 1903 and 1904.

[Drainage area, 250 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
June	2,065	236	893	53,140	3.57	3.98
July	270	105	172	10,580	.688	.793
August	105	58	76.4	4,698	.306	.353
September	105	47	60.2	3,582	.241	.269
October	96	47	63.2	3,886	.253	.292
November	58	38	45.3	2,696	.181	.202
December	31	31	31.0	1,906	.124	.143
1904.						
January	31	31	31.0	1,906	0.124	0.143
February	71	25	30.9	1,777	.124	.134
March	42	25	26.3	1,617	.105	.121
April	523	31	182	10,830	.728	.812
May	985	176	511	31,420	2.04	2.35
June	568	126	309	18,390	1.24	1.38
July	126	87	107	6,579	.428	.493
August	116	71	86.2	5,300	.345	.398
September	205	71	78.8	4,689	.315	.351
October	79	58	69.2	4,255	.277	.319
November	71	38	53.3	3,172	.213	.238
December	47	31	36.5	2,244	.146	.168
The year	985	25	127	92,180	.507	6.91

ASHLEY CREEK (DRY FORK) NEAR VERNAL, UTAH.

The many branches of Ashley Creek drain an area of approximately 250 square miles in northeastern Utah. This area is situated entirely within the Uinta Forest Reserve, in Uinta County, between the drainage areas of Brush Creek, Green River, and Uinta River. The streams receive their water from a series of small lakes on the summit and the southern slopes of the Uinta Mountains, thus insuring a never-failing supply. They finally join at the base of the mountains, and enter Ashley Valley 8 miles above the town of Vernal in one stream. The peculiar feature of the streams between the Uinta River and Green River is that at some point in their course they disappear, except during the spring floods, and that, with the exception of Dry Fork, which

is the most westerly branch of Ashley Creek, reappear later in the year.

Dry Fork has its source in a lake in the Uinta Mountains, about 35 miles northwest of Vernal, Utah. Its length is about 28 miles, and for 23 miles it flows in a canyon varying from 500 feet to one-half mile in width. Its general direction is southeast, and it has a fall of at least 150 feet per mile. It enters Ashley Creek about 8 miles above the town of Vernal. About midway the stream's length, or 10 miles northwest of Dry Fork post-office, a gaging was made on August 20, 1901, which gave a discharge of 96 second-feet. About 1,200 feet below this point occurs a pool, or sink, lying in a circular basin whose banks, except on the upstream side, are from 75 to 100 feet high. The stream enters this pool through several inlets. The pool is apparently bottomless. The water in its larger end has a slow circular motion, but whether this is caused by the incoming stream or by suction from below could not be determined. The only visible outlet is a narrow, rocky channel which has been widened by blasting in an effort to increase its flow. When visited in 1901 this was carrying about 10 second-feet, all of which disappeared within a mile below.

Only three times since 1879 has the water reappeared in the channel of Dry Fork after the spring floods have subsided. One of these was during the last year.

The first flow of 1904 commenced on the night of May 12, when, approximately, the stream was carrying 100 second-feet. It reached its maximum height May 22, which it held until May 24, when a measurement was made just above its mouth. It was then carrying 308 second-feet, or practically 42 per cent of the discharge of Ashley Creek at the station about 1 mile below the junction of Dry Fork with the main stream. The flow gradually decreased from day to day until July 15, 1904, when it completely subsided. Previous to and at the time of the maximum discharge of this branch, it, in all probability, was carrying more than 42 per cent of the entire discharge at the station, for the season of high water during average years does not occur on this branch until after the greater portion of Ashley Creek's high water has passed. As an approximation of what this stream was carrying, the following tables, which are thought to be a fair estimate of its discharge, have been prepared.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Mean daily discharge, in second-feet, of Ashley Creek (Dry Fork) near Vernal, Utah, for 1904.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1	.....	260	80	12	100	194	14	23	350	128	.....
2	.....	254	74	13	117	188	10	24	308	122	.....
3	.....	248	68	14	134	182	6	25	302	116	.....
4	.....	242	62	15	151	176	0	26	296	110	.....
5	.....	236	56	16	168	170	.....	27	290	104	.....
6	.....	230	50	17	185	164	.....	28	284	98	.....
7	.....	224	44	18	202	158	.....	29	278	92	.....
8	.....	218	38	19	219	152	.....	30	272	86	.....
9	.....	212	32	20	260	146	.....	31	266	.....	.....
10	.....	206	26	21	300	140	.....				
11	.....	200	20	22	350	134	.....				

Estimated monthly discharge of Ashley Creek (Dry Fork) near Vernal, Utah, for 1904.

Month.	Dicharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 12–31	350	100	242	9,584
June	260	86	173	10,290
July 1–15	80	0	38	1,150

WHITE RIVER (NORTH FORK) NEAR BUFORD, COLO.

This station was established July 28, 1903, by Robert S. Stockton. It is located at the county bridge at Rawson's ranch, below the mouth of Marvine Creek, 7 miles from Buford, the nearest post-office, and 32 miles from Meeker, Colo. The gage is a 2 by 4 inch vertical pine timber, spiked to the lower side of the first pier from the south end of the bridge. It reads from 1 to 9 feet. It is read twice each day by H. N. Rawson. Discharge measurements are made from the three-span highway bridge to which the gage is attached. It has a total span of 85 feet. The initial point for soundings is the edge of the abutment at the south end of the bridge. The channel is straight for 200 feet above and 300 feet below the station, and the current is swift. Both banks are high and are not liable to overflow. The right bank is covered with trees and brush. The bed of the stream is rocky and free from vegetation. There is but one channel at all stages, broken by the two narrow bridge piers. Bench mark No. 1 is the top of a bolt on the bridge nearest the gage. Its elevation is 11.51 feet above the zero of the gage. Bench mark No. 2 is a spike in the trunk of a large cottonwood tree at the southeast corner of the bridge. Its elevation is 7.46 feet above the zero of the gage. Bench mark No. 3 is

a spike in one of the abutment logs at the end of the upper sill at the southwest corner of the bridge. Its elevation is 7.88 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of White River (North Fork) near Buford, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 26	O. McDermith	87	118	3.92	2.40	462
June 4	do	87	162	4.70	3.00	762
July 7	do	87	118	3.82	2.40	451
August 3	do	82	90	3.27	2.08	294
September 10	do	82	77	3.04	2.00	234

Mean daily gage height, in feet, of White River (North Fork) near Buford, Colo., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.00	2.98	3.30	2.60	2.08	2.10	2.00
2	1.95	2.80	3.20	2.55	2.08	2.05	2.00
3	1.85	2.62	3.15	2.50	2.05	2.05	1.98
4	1.92	2.45	3.05	2.50	2.05	2.00	1.95
5	1.95	2.55	3.05	2.40	2.05	2.00	1.95
6	1.90	2.65	2.92	2.40	2.05	2.00	1.98
7	1.90	2.80	2.92	2.40	2.05	2.00	2.02
8	1.95	2.65	2.95	2.40	2.05	2.00	2.00
9	1.90	2.68	3.05	2.35	2.05	2.00	2.05
10	1.88	2.92	3.25	2.30	2.05	2.00	2.00
11	1.95	3.05	3.30	2.28	2.05	2.00	2.00
12	2.05	3.25	3.30	2.25	2.05	2.00	2.00
13	2.12	3.40	3.40	2.28	2.05	2.00	2.00
14	2.20	3.25	3.55	2.25	2.05	1.98	2.00
15	2.28	3.20	3.40	2.22	2.05	1.95	2.00
16	2.38	3.30	3.35	2.22	2.05	1.95	1.95
17	2.42	3.35	3.15	2.20	2.05	1.98	1.95
18	2.70	3.45	3.10	2.18	2.10	2.00	1.95
19	2.68	3.42	3.12	2.18	2.05	1.95	1.95
20	2.80	3.25	3.05	2.15	2.05	1.95	1.92
21	2.65	3.20	3.05	2.15	2.05	1.95	1.92
22	2.30	3.30	2.98	2.15	2.05	2.00	1.92
23	2.05	3.45	2.90	2.15	2.00	1.98	1.92
24	2.15	3.45	2.82	2.15	2.00	1.98	1.92
25	2.40	3.40	2.75	2.15	2.00	2.00	1.92
26	2.58	3.42	2.72	2.15	2.00	2.00	1.92
27	2.68	3.35	2.70	2.15	2.00	1.98	1.92
28	3.15	3.30	2.68	2.15	2.12	1.98	1.92
29	2.95	3.35	2.65	2.20	2.02	2.00	1.92
30	3.00	3.30	2.65	2.12	2.00	2.00	1.92
31	.....	3.30	.....	2.12	2.02	.....	1.92

Rating table for White River (North Fork) near Buford, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.85	175	2.15	325	2.45	475	3.00	760
1.90	200	2.20	350	2.50	500	3.10	820
1.95	225	2.25	375	2.60	550	3.20	880
2.00	250	2.30	400	2.70	600	3.30	940
2.05	275	2.35	425	2.80	650	3.40	1,000
2.10	300	2.40	450	2.90	700	3.50	1,060

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is well defined between gage heights 2.00 feet and 3.00 feet. The table has been extended beyond these limits. Above gage height 3.00 feet the rating curve is a tangent, the difference being 60 per tenth.

Estimated monthly discharge of White River (North Fork) near Buford, Colo., for 1904.

[Drainage area, 181 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	850	175	396	23,560	2.19	2.43
May	1,030	475	841	51,710	4.65	5.36
June	1,090	575	794	47,250	4.39	4.90
July	550	310	383	23,550	2.12	2.44
August	310	250	272	16,720	1.50	1.73
September	300	225	247	14,700	1.36	1.52
October	275	210	230	14,140	1.27	1.47
The period				191,600		

WHITE RIVER (SOUTH FORK) NEAR BUFORD, COLO.

This station was established July 25, 1903, by Robert S. Stockton. It is located at the county bridge at the lower end of a section of the river known as the "Stillwater." It is about 7 miles from Buford, Colo., the nearest post-office, and is about 30 miles from Meeker, Colo. The elevation above sea level as determined by aneroid barometer is 7,400 feet. The gage is a 2 by 4 inch vertical pine timber 10 feet long. It is spiked to the upper side of the middle pier. It is read twice each day by George Hazard. Discharge measurements are made from the bridge at high water and by wading at low water. The initial point for soundings is the edge of the abutment at the west end of the bridge. The bridge makes an angle of 22° with the normal to the stream. This is taken into account in making measurements. The channel is straight for 50 feet above the station and for 300 feet below. The current is swift. Both banks are high, covered with grass and sagebrush, and are not subject to overflow. The bed of the stream below the Stillwater and at the gaging station is covered with bowlders, some of which are 2 or 3 feet in diameter. There is but one channel, broken by the middle pier of the bridge. Bench mark No. 1 is the first bolt on the bridge east of the gage. Its elevation is 11.95 feet above the zero of the gage. Bench mark No. 2 is a spike in one of the logs of the abutment at the southwest corner of the bridge. Its elevation is 8.57 feet above the zero of the gage. Bench mark No. 3 is the corner of a large rock 30 feet west of the bridge and north of the road. Its elevation is 13.14 feet above the zero of the gage. Bench mark No. 4 is the top of a pyramid-shaped rock on the east side of the river below the bridge, 41 feet distant from the northeast bolt on the bridge tie. The rock projects 8 inches above the ground. The elevation of the bench mark is 7.02 feet above the zero of the gage. The bridge has a span between abutments of 55 feet.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of White River (South Fork) near Buford, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 25	McDermith and Lamb	49	80	3.39	2.80	271
June 2	O. McDermith	56	187	6.00	4.85	1,122
July 6	do	54	101	3.72	3.18	376
August 2	do	46	62	3.64	2.70	226
September 13	do	43	58	2.52	2.51	146

Mean daily gage height, in feet, of White River (South Fork) near Buford, Colo., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.42	3.20	5.20	3.35	2.68	2.70	2.55
2	2.42	3.22	5.15	3.32	2.65	2.68	2.55
3	2.42	3.15	4.70	3.25	2.65	2.62	2.50
4	2.42	3.08	4.22	3.22	2.65	2.60	2.50
5	2.42	3.02	3.90	3.18	2.65	2.55	2.50
6	2.42	3.00	3.88	3.12	2.65	2.55	2.50
7	2.42	3.15	4.22	3.10	2.65	2.55	2.62
8	2.42	3.12	4.50	3.10	2.60	2.50	2.58
9	2.42	3.10	4.40	3.02	2.60	2.50	2.58
10	2.45	3.18	4.70	3.00	2.60	2.50	2.60
11	2.50	3.30	5.45	3.00	2.60	2.50	2.58
12	2.62	3.58	5.10	2.95	2.60	2.50	2.60
13	2.72	3.70	5.40	2.95	2.60	2.50	2.58
14	2.80	3.85	5.35	2.95	2.60	2.50	2.55
15	2.82	3.88	4.65	2.90	2.60	2.50	2.52
16	2.85	3.72	4.45	2.88	2.60	2.50	2.50
17	2.90	3.72	4.35	2.82	2.60	2.50	2.50
18	2.95	3.98	4.30	2.80	2.65	2.55	2.50
19	3.00	4.40	4.35	2.80	2.65	2.52	2.48
20	3.00	4.45	4.28	2.80	2.62	2.50	2.45
21	3.02	4.55	4.05	2.78	2.60	2.50	2.48
22	2.95	4.78	3.90	2.75	2.55	2.55	2.45
23	2.90	5.55	3.78	2.75	2.55	2.68	2.50
24	2.82	6.25	3.78	2.80	2.55	2.58	2.50
25	2.80	6.00	3.65	2.75	2.55	2.52	2.48
26	2.88	5.35	3.60	2.75	2.55	2.60	2.48
27	2.95	5.35	3.55	2.70	2.58	2.58	2.48
28	3.10	5.30	3.50	2.75	2.70	2.55	2.48
29	3.18	5.30	3.45	2.75	2.65	2.55	2.48
30	3.18	5.50	3.42	2.72	2.65	2.58	2.48
31	.....	5.60	.....	2.70	2.60	.....	2.50

Rating table for White River (South Fork) near Buford, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.40	154	3.10	362	3.80	640	5.00	1,200
2.45	165	3.15	380	3.85	660	5.10	1,250
2.50	177	3.20	400	3.90	680	5.20	1,300
2.55	190	3.25	420	3.95	700	5.30	1,350
2.60	204	3.30	440	4.00	720	5.40	1,400
2.65	219	3.35	460	4.10	760	5.50	1,450
2.70	234	3.40	480	4.20	800	5.60	1,500
2.75	249	3.45	500	4.30	850	5.70	1,550
2.80	264	3.50	520	4.40	900	5.80	1,600
2.85	280	3.55	540	4.50	950	5.90	1,650
2.90	296	3.60	560	4.60	1,000	6.00	1,700
2.95	312	3.65	580	4.70	1,050	6.10	1,750
3.00	328	3.70	600	4.80	1,100	6.20	1,800
3.05	345	3.75	620	4.90	1,150		

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is not well defined and has been extended above gage height 4.85 feet. Above gage height 4.20 feet the rating curve is a tangent, the difference being 50 per tenth.

Estimated monthly discharge of White River (South Fork) near Buford, Colo., for 1904.

[Drainage area, 148 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	392	158	251	14,940	1.70	1.89
May	1,825	328	834	51,280	5.64	6.50
June	1,425	488	872	51,890	5.89	6.57
July	460	234	307	18,880	2.07	2.39
August	234	190	208	12,790	1.40	1.62
September	234	177	191	11,370	1.29	1.44
October	210	165	182	11,190	1.23	1.42
The period				172,300		

WHITE RIVER NEAR MEEKER, COLO.

This station was established by A. L. Fellows, May 24, 1901, about one-half mile above the town of Meeker, at a point where a wagon bridge crosses the stream on the ranch of L. F. Van Cleave. The gage rod consists of a vertical 2 by 4 inch timber nailed to the left abutment of the bridge on the downstream side. The bridge is marked every 5 feet. The initial point for soundings is at the rod at the left or south end of the bridge. The channel is straight for 500 feet above and below the station. The current is swift. There is but one channel at all stages. The banks are so high that they are not liable to overflow; the channel is of rock and gravel and seems permanent in its nature. Measurements are made from the lower side of the wagon bridge. The observer is L. F. Van Cleave, who reads the rod twice each day. Bench mark No. 1 is top of bolt in truss immediately above gage rod; elevation above zero of gage, 10.83 feet. Bench mark No. 2 is spike driven in left post of gate near bottom; elevation above zero of gage, 9.29 feet. Bench mark No. 3 is a nail on south side of post directly east of bench mark No. 2; elevation above zero of gage, 9.14 feet. Bench mark No. 4 is a United States Geological Survey standard iron bench mark located 30 feet north of the north end of the bridge. Its elevation is 8.807 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of White River near Meeker, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 12	O. McDermith	79	207	2.74	4.00	568
April 23	do	79	258	3.37	4.60	871
April 27	W. A. Lamb	79	275	3.65	4.75	1,003
May 23	O. McDermith	79	367	6.21	5.79	2,280
May 31	do	79	362	6.41	5.80	2,322
June 13	do	79	358	6.37	5.77	2,282
July 5	do	79	228	3.18	4.33	724
August 1	do	79	188	2.09	3.70	392
August 15	do	79	191	2.13	3.71	406
September 8	do	79	184	2.24	3.75	412

Mean daily gage height, in feet, of White River near Meeker, Colo., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.70	5.20	5.65	4.52	3.70	3.98	3.78
2	3.70	5.12	5.65	4.48	3.70	3.95	3.75
3	3.65	4.95	5.60	4.42	3.68	3.85	3.72
4	3.65	4.82	5.35	4.38	3.68	3.80	3.68
5	3.62	4.75	5.15	4.32	3.68	3.75	3.65
6	3.62	4.82	5.10	4.30	3.68	3.75	3.65
7	3.60	5.02	5.18	4.30	3.65	3.72	3.70
8	3.55	4.85	5.40	4.32	3.65	3.70	3.70
9	3.60	4.80	5.40	4.20	3.68	3.70	3.82
10	3.62	5.00	5.40	4.20	3.65	3.70	3.85
11	3.82	5.20	5.70	4.15	3.68	3.70	3.82
12	3.95	5.45	5.60	4 10	3.72	3.65	3.80
13	4.08	5.50	5.72	4.10	3.70	3.65	3.78
14	4.25	5.55	5.58	4.08	3.68	3.65	3.75
15	4.45	5.62	5.55	4.00	3.70	3.65	3.75
16	4.50	5.42	5.42	3.98	3.70	3.70	3.75
17	4.55	5.42	5.38	3.90	3.70	3.68	3.75
18	4.65	5.45	5.32	3.88	3.90	3.75	3.70
19	4.90	5.65	5.32	3.85	3.85	3.75	3.68
20	4.80	5.65	5.30	3.78	3.85	3.70	3.68
21	5.05	5.55	5.18	3.80	3.78	3.65	3.68
22	4.70	5.55	5.15	3.78	3.70	3.68	3.70
23	4.55	5.78	5.02	3.75	3.70	3.65	3.70
24	4.52	5.90	5.02	3.80	3.70	3.68	3.70
25	4.38	5.92	4.95	3.80	3.70	3.70	3.70
26	4.55	5.75	4.82	3.75	3.70	3.80	3.70
27	4.78	5.70	4.75	3.72	3.78	3.75	3.68
28	5.12	5.70	4.65	3.70	3.95	3.72	3.68
29	5.28	5.70	4.62	3.80	3.88	3.72	3.68
30	5.10	5.72	4.58	3.78	3.85	3.75	3.68
31	.....	5.75	.....	3.72	3.90	.....	3.68

Rating table for White River near Meeker, Colo., from April 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.55	335	3.95	515	4.60	890	5.30	1,590
3.60	355	4.00	540	4.70	960	5.40	1,730
3.65	375	4.10	590	4.80	1,040	5.50	1,870
3.70	395	4.20	650	4.90	1,130	5.60	2,010
3.75	415	4.30	710	5.00	1,230	5.70	2,160
3.80	440	4.40	770	5.10	1,350	5.80	2,320
3.85	465	4.50	830	5.20	1,470	5.90	2,480
3.90	490						

The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1904. It is well defined between gage heights 3.70 feet and 4.75 feet. The upper part of the curve is determined by 4 measurements near gage height 5.75 feet.

Estimated monthly discharge of White River near Meeker, Colo., for 1904.

[Drainage area, 634 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	1,566	335	745	44,330	1.18	1.32
May	2,512	1,000	1,763	108,400	2.78	3.20
June	2,192	878	1,570	93,420	2.48	2.77
July	842	395	559	34,370	.882	1.02
August	515	375	413	25,390	.651	.750
September	530	375	409	24,340	.645	.720
October	465	375	404	24,840	.637	.734
The period				355,100		

WHITE RIVER NEAR RANGELY, COLO.

This station was established April 14, 1904, by Oro McDermith. It is located at the wagon bridge 1 mile west of Rangely, Colo. The gage is a 2 by 4 inch timber 12 feet long, graduated to feet and tenths, fastened to the masonry abutment at the right bank. It is read twice each day by John Gothard. Discharge measurements are made from the downstream side of the single-span bridge to which the gage is attached. The initial point for soundings is the vertical wall of the right abutment. Distances from the initial point are marked with white paint on the hand rail of the bridge. The channel is straight for about 150 feet above and for 200 feet below the station. The current is swift, but at low stages becomes rather sluggish above the bridge. The right bank is high and clean and does not overflow. The left bank is low and clean and is subject to overflow. On this bank the roadway approaches the bridge on an embankment. The bed of the stream is composed of sand and is shifting. There is but one channel at all stages. The bridge is not quite at right angles to the course of the stream. A United States Geological Survey standard aluminum bench-mark tablet is set on the top stone of the right abutment on the downstream side. Its elevation is 16.857 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of White River near Rangely, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
April 14	O. McDermith	78	223	2.98	3.95	665
May 28	do	87	398	5.38	5.65	2,120
July 12	do	75	248	2.46	3.90	609
August 9	do	72	195	1.53	3.45	298
September 18	do	72	155	2.69	3.58	417

Mean daily gage height, in feet, of White River near Rangely, Colo., for 1904.

Day.	Apr.	May.	June	July	Aug.	Sept.	Oct.	Nov.
1	.....	4.65	5.50	4.20	3.40	4.10	3.50	3.50
2	.....	4.65	5.45	4.20	3.40	3.95	3.50	3.50
3	.....	4.60	5.45	4.20	3.40	3.85	3.50	.....
4	.....	4.55	5.45	4.20	3.40	3.75	3.50	.....
5	.....	4.45	5.25	4.15	3.40	3.70	3.50	.....
6	.....	4.35	5.10	4.00	3.40	3.60	3.60	.....
7	.....	4.35	5.00	4.00	3.40	3.60	3.60	.....
8	.....	4.50	5.55	4.00	3.40	3.60	3.60	.....
9	.....	4.40	5.60	4.00	3.40	3.50	3.65	.....
10	.....	4.35	5.40	4.00	3.40	3.50	3.65	.....
11	.....	4.45	5.25	4.00	3.76	3.50	3.70	.....
12	.....	4.80	5.40	3.95	3.55	3.50	3.70	.....
13	.....	4.95	5.35	3.90	3.50	3.50	3.60	.....
14	.....	5.00	5.45	3.90	3.50	3.50	3.60	.....
15	4.00	5.20	5.50	3.90	3.50	3.50	3.60	.....
16	4.00	5.20	5.40	3.80	3.50	3.50	3.60	.....
17	4.02	5.20	5.35	3.80	4.15	3.50	3.60	.....
18	4.04	5.05	5.15	3.70	3.90	3.55	3.60	.....
19	4.04	5.10	4.95	3.70	3.90	3.60	3.60	.....
20	4.06	5.25	4.95	3.60	3.85	3.60	3.60	.....
21	4.04	5.30	4.95	3.60	3.75	3.60	3.60	.....
22	4.05	5.20	4.80	3.60	3.70	3.50	3.60	.....
23	4.04	5.25	4.75	3.50	3.70	3.50	3.60	.....
24	4.19	5.40	4.60	3.50	3.70	3.50	3.60	.....
25	4.04	5.65	4.60	3.50	3.70	3.50	3.60	.....
26	4.18	5.90	4.55	3.50	3.65	3.50	3.60	.....
27	4.02	5.60	4.55	3.40	3.60	3.50	3.60	.....
28	4.03	5.45	4.45	3.30	3.60	3.50	3.50	.....
29	4.06	5.45	4.30	3.30	3.75	3.50	3.50	.....
30	4.53	5.45	4.25	3.95	4.05	3.50	3.50	.....
31	.....	5.65	.....	3.40	3.80	.....	3.50	.....

Rating table for White River near Rangely, Colo., from April 14 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.30	225	3.75	515	4.40	990	5.20	1,685
3.35	255	3.80	550	4.50	1,070	5.30	1,775
3.40	285	3.85	585	4.60	1,150	5.40	1,870
3.45	315	3.90	620	4.70	1,235	5.50	1,970
3.50	345	3.95	655	4.80	1,325	5.60	2,070
3.55	375	4.00	690	4.90	1,415	5.70	2,170
3.60	410	4.10	760	5.00	1,505	5.80	2,270
3.65	445	4.20	830	5.10	1,595	5.90	2,370
3.70	480	4.30	910				

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is not well defined.

Estimated monthly discharge of White River near Rangely, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 15–30	1,110	690	753	23,900
May	2,370	950	1,527	93,890
June	2,070	870	1,582	94,130
July	830	225	552	33,940
August	795	285	427	26,260
September	760	345	401	23,860
October	480	345	399	24,530
The period				321,500

WHITE RIVER NEAR OURAY, UTAH.

This station was established March 22, 1904, by H. S. Reed. It is located at the site of the White River Dam and Canal Company's dam, 14 miles from Ouray, Utah. The nearest town is Vernal, Utah, 30 miles distant, and the nearest railroad station is Price, Utah, 130 miles distant. The station is below all tributaries. A vertical staff gage is attached to the upstream face of the crib work of the dam near the right bank. It is read twice each day by T. T. Holdaway. Discharge measurements are made by wading and by means of a boat at a point about 600 feet below the dam, by stretching a tagged rope across the stream and there is a good current. The channel is straight for about 600 feet above and 1,500 feet below the station. Both banks are high and do not overflow. The bed of the stream is composed of clean sand and is shifting. The bench mark is a T cut in the solid rock about 100 feet northeast of the gage rod on the right bank. Its elevation is 13.185 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Discharge measurements of White River near Ouray, Utah, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 22	H. S. Reed	104	224	1.80	2.00	403
June 4	do	103	578	3.53	5.90	2,040
August 15	do	107	186	1.76	2.10	328
October 28	do	108	192	1.79	2.20	344

Mean daily gage height, in feet, of White River near Ouray, Utah, for 1904.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1		2.20	4.40	6.15	17		2.75	5.30	5.50
2		2.05	4.25	5.85	18		3.00	5.00	5.45
3		2.05	4.40	5.70	19		3.10	4.82	5.00
4		2.10	4.60	5.82	20		3.30	5.05	4.85
5		1.95	3.85	5.70	21		3.55	5.50	4.80
6		1.92	3.75	5.05	22	2.00	3.90	5.60	
7		1.98	3.60	4.65	23		3.78	5.20	
8		1.88	3.70	4.50	24		3.48	5.55	
9		1.85	4.05	6.70	25		3.25	5.80	
10		1.80	3.80	5.25	26		3.20	7.10	
11		1.78	3.65	5.05	27		2.98	6.70	
12		1.75	3.95	5.25	28		3.05	6.15	
13		1.85	4.40	5.20	29		3.45	5.70	
14		2.00	4.75	5.50	30		4.05	5.75	
15		2.25	4.95	5.70	31			5.70	
16		2.50	5.08	5.90					

MARVINE CREEK NEAR BUFORD, COLO.

This station is located at a point where the stream is crossed by a large aspen log. The nearest post-office is Buford, Colo., about 10 miles distant. Meeker, Colo., is about 35 miles distant. The elevation of this point, as determined by an aneroid barometer, is 7,550 feet above sea level. The gage is a vertical 2 by 4 inch pine timber 5 feet long, fastened to the lower side of the foot log, which is used as a bridge. Discharge measurements are made from the log which spans the stream at the gage. The channel is 30 feet wide at this point. The initial point for soundings is at the gage rod. The channel is straight for 100 feet above and below the station, and the current is swift. The right bank is sloping and will overflow for 10 or 15 feet at high water. The left bank is steep and will not overflow. Both banks are covered with thick brush. The bed of the stream at the station is covered with bowlders and is free from vegetation. The channel is divided into two parts by a large sunken log, which supports the middle of the foot bridge. Bench mark No. 1 is the top of a rock 22 feet west of the gage rod. Its elevation is 4.62 feet above the zero of the gage. Bench mark No. 2 is the top of a triangular-shaped rock between two spruce trees on the west bank. Its elevation is 6.01 feet above the zero of the gage. Bench mark No. 3 is the top of a large rock 30 feet northwest of the gage. Its elevation is 4.61 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Marvine Creek near Buford, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 26	McDermith and Lamb	29	36	2.75	2.00	99
June 4	O. McDermith	30	46	5.30	2.50	244
July 7	do	30	44	3.55	2.15	156
August 3	do	26	35	4.29	2.07	150
September 10	do	28	32	3.34	1.90	107

Mean daily gage height, in feet, of Marvine Creek near Buford, Colo., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.15	2.50	2.20	1.95	2.05	1.85
2	.....	2.18	2.45	2.20	1.95	2.00	1.85
3	.....	2.10	2.50	2.20	1.85	1.90	1.85
4	.....	2.20	2.50	2.20	2.00	1.90	1.85
5	.....	2.15	2.45	2.25	2.00	1.90	1.85
6	.....	2.15	2.45	2.20	2.00	1.90	1.85
7	.....	2.15	2.45	2.15	2.00	1.90	1.90
8	.....	2.15	2.50	2.15	2.00	1.90	1.85
9	.....	2.20	2.50	2.15	2.00	1.90	1.90
10	.....	2.25	2.50	2.10	2.00	1.90	1.88
11	.....	2.28	2.55	2.10	2.00	1.90	1.85
12	.....	2.35	2.70	2.10	2.00	1.90	1.88
13	.....	2.35	2.80	2.05	1.90	1.90	1.85
14	.....	2.35	2.60	2.00	1.90	1.88	.....
15	.....	2.30	2.50	2.00	1.90	1.88	.....
16	.....	2.32	2.45	2.00	1.90	1.90	.....
17	.....	2.35	2.45	2.00	1.90	1.85	.....
18	.....	2.40	2.40	2.00	2.00	1.85	.....
19	.....	2.45	2.35	2.00	1.95	1.85	.....
20	.....	2.42	2.40	2.00	1.95	1.85	.....
21	.....	2.48	2.35	2.00	2.00	1.85	.....
22	.....	2.45	2.35	1.97	1.90	1.85	.....
23	.....	2.45	2.35	1.97	1.90	1.90	.....
24	.....	2.45	2.30	1.97	1.90	1.88	.....
25	.....	2.50	2.15	1.97	1.90	1.85	.....
26	2.10	2.45	2.15	1.93	1.90	1.90	.....
27	2.20	2.55	2.10	1.93	1.90	1.85	.....
28	2.20	2.55	2.20	1.95	2.00	1.85	.....
29	2.18	2.50	2.25	1.95	2.00	1.85	.....
30	2.15	2.55	2.20	1.95	2.00	1.90	.....
31	.....	2.55	.....	1.95	2.05	.....	.....

Rating table for Marvine Creek near Buford, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.75	64	2.05	136	2.35	208	2.65	280
1.80	76	2.10	148	2.40	220	2.70	292
1.85	88	2.15	160	2.45	232	2.75	304
1.90	100	2.20	172	2.50	244	2.80	316
1.95	112	2.25	184	2.55	256	2.85	328
2.00	124	2.30	196	2.60	268	2.90	340

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is not well defined. The rating curve is a tangent, the difference being 24 per tenth.

Estimated monthly discharge of Marvine Creek near Buford, Colo., for 1904.

[Drainage area, 50 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April 26–30	172	148	164	1,630	3.28	0.608
May	256	148	207	12,730	4.14	4.77
June	316	148	223	13,270	4.46	4.98
July	184	107	136	8,362	2.72	3.14
August	136	88	113	6,948	2.26	2.60
September	136	88	97.5	5,802	1.95	2.18
October 1–13	100	88	90.9	2,344	1.82	.886
The period				51,090		

UINTA RIVER NEAR WHITEROCKS, UTAH.[a]

This station was established September 16, 1899, by C. C. Babb. It is located at the point where the river emerges from its canyon, about 10 miles northwest of the Indian agency at Whiterocks, Utah. The station is on the road to the Government sawmill, and is three-fourths of a mile above the bridge. It is 600 feet below the mouth of Pole Creek. The gage is an inclined 2 by 4 inch timber, 12 feet long, bolted to two trees on the left bank. Discharge measurements are made at flood stages by means of a cable and car. At ordinary stages they are made by wading. The initial point for soundings is the first tag on the barbed wire from the left cable support. The channel is straight for 600 feet above and below the station. The current is swift, and at high stages difficulty is experienced in keeping the meter in position on account of the high velocity and rough bed. The right bank is high and rocky, with a few trees. It probably will not overflow. The left bank is lower than the right, is covered in places with a growth of willows, and will overflow at flood stages. The bed of the stream is rough and rocky and is covered with large bowlders. There are two channels at all stages. The bench mark is a nail on an aspen tree 125 feet north of the gage. Its elevation is 8.93 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

[a] Gage heights at this station are only observed when visits are made by the hydrographer, so daily discharge measurements will have to be obtained by interpolation.

Discharge measurements of Uinta River near Whiterocks, Utah, in 1904.

Date.	Hydrographer.	Gage height.	Area of section.	Mean velocity.	Discharge.
		Feet.	*Square feet.*	*Ft. per sec.*	*Second-feet.*
March 15	H. S. Reed	0.80	46	2.28	105
March 15[a]	do	0.80	43	2.40	103
April 23	do	.95	49	2.49	122
May 27	do	2.12	113	5.77	652
May 27[a]	do	2.12	123	6.14	755
June 18	do	1.85	106	4.82	511
June 18[a]	do	1.85	111	5.35	594
August 29	do	1.25	59	3.95	233

[a] Made at bridge.

UINTA RIVER AT FORT DUCHESNE, UTAH.

This station was established September 14, 1899, by C. C. Babb. It is located at the highway bridge at the military post. The gage is a vertical rod 2 by 4 inches, 10 feet long, nailed to the old bridge abutment on the right bank 15 feet north of the bridge. This new rod was established April 19, 1904. It is read twice each day by Fred. Hoeft. Discharge measurements are made at high water from the bridge, and at ordinary stages by wading at a point 200 feet below. When measurements are made from the bridge the initial point for soundings is a zero marked on the west end of the bridge stringer on the downstream side. At the wading section the initial point is the first tag on the wire on the right bank. A tagged wire is stretched just below the bridge. The channel is curved both above and below the station and makes a half circle at the gaging section. The current is sluggish near the left bank, but is swift near the right bank. Both banks are low and subject to overflow. The right bank is covered with a heavy undergrowth. The bed of the stream is rocky, though at times the section is filled in with sediment brought down by Deep Creek during floods. Bench mark No. 1 is the head of a nut in the extreme southwest end of the upper stringer of the bridge. Its elevation above gage datum is 8.91 feet, and 4,994.00 feet above sea level, Evanston datum. Bench mark No. 2 is a large nail below a line of nails driven into a scarp cut into a large cottonwood tree situated on the left bank about 300 feet from the east end of the bridge. Its elevation above gage datum is 9.90 feet, and 4,994.99 feet above sea level, Evanston datum.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Discharge measurements of Uinta River at Fort Duchesne, Utah, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 2	H. S. Reed	47	66	2.12	2.73	140
March 12 [a]	do	40	46	1.04	2.41	48
March 17 [a]	do	47	54	1.43	2.55	77
March 26 [a]	do	40	41	.80	2.35	33
April 15 [a]	do	48	60	1.85	2.65	111
April 18 [a]	do	48	56	1.73	2.60	97
April 18 [b]	do	67	73	1.14	2.60	83
April 19 [a]	do	48	58	1.76	2.63	103
April 19 [b]	do	67	76	1.14	2.63	87
April 23 [b]	Reed and Murphy	64	68	1.03	2.57	70
April 30 [b]	H. S. Reed	70	88	1.73	2.85	152
May 20 [c]	Reed and Curtis	54	268	5.22	4.68	1,399
May 21 [c]	do	54	258	4.94	4.60	1,274
June 1 [c]	H. S. Reed	54	247	3.96	4.20	977
June 13 [c]	do	54	232	2.82	3.90	655
June 14 [d]	do	54	238	3.25	4.00	773
June 14 [e]	do	54	237	3.40	4.00	805
June 22 [e]	do	54	225	2.39	3.65	537
June 22 [d]	do	54	226	2.28	3.65	516
July 8 [a]	do	75	97	3.32	3.20	322
July 8 [b]	do	80	121	2.46	3.20	298
July 13 [a]	do	72	87	2.49	3.00	217
July 13 [b]	do	76	100	1.99	3.00	199
July 14 [c]	do	53	194	.99	2.93	192
July 14 [d]	do	53	191	1.00	2.93	191
July 14 [a]	do	64	81	2.43	2.93	197
July 14 [b]	do	76	98	1.85	2.93	181
August 1 [b]	do	68	87	1.55	2.81	135
August 1 [a]	do	52	68	2.16	2.81	147
August 22 [b]	do	68	82	1.48	2.75	121
August 22 [a]	do	50	64	2.09	2.75	134
September 10 [a]	do	48	56	1.66	2.65	93
September 10 [b]	do	67	73	1.22	2.65	89
November 3 [a]	do	50	58	2.49	2.80	144
November 4 [a]	do	50	52	2.21	2.75	115
November 4 [b]	do	68	80	1.36	2.75	109

[a] Measurement made by wading at old upper or 1903 section.
[b] Measurement made by wading at new lower or 1904 section.
[c] Made from bridge.
[d] Made from bridge, using 5-foot sections.
[e] Made from bridge, using 2-foot sections.

Mean daily gage height, in feet, of Uinta River at Fort Duchesne, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	(a)	2.73	2.60	2.89	4.10	3.20	2.80	2.82	2.80	2.90	2.72
2	(a)	(a)	2.70	2.60	2.91	4.08	3.20	2.79	2.75	2.80	2.90	2.70
3	(a)	(a)	2.70	2.58	2.92	3.98	3.08	2.75	2.72	2.79	2.90	2.70
4	(a)	(a)	2.70	2.60	2.90	3.90	3.01	2.72	2.73	2.78	2.89	(a)
5	(a)	(a)	2.69	2.60	2.88	3.82	3.10	2.70	2.78	2.78	2.89	(a)
6	(a)	(a)	2.68	2.58	2.83	3.78	3.09	2.69	2.74	2.88	2.89	(a)
7	(a)	(a)	2.65	2.55	2.86	3.85	3.17	2.69	2.72	2.90	2.89	(a)
8	(a)	(a)	2.65	2.52	2.91	4.15	3.18	2.66	2.70	2.89	2.89	(a)
9	(a)	(a)	2.65	2.50	2.95	3.98	3.12	2.64	2.69	2.92	2.90	(a)
10	(a)	(a)	2.62	2.50	3.16	3.90	3.08	2.60	2.67	2.90	2.89	(a)
11	(a)	(a)	2.53	2.58	3.40	3.95	3.05	2.75	2.65	2.90	2.88	(a)
12	(a)	(a)	2.51	2.63	3.78	4.04	3.00	2.70	2.66	2.99	2.85	(a)
13	(a)	(a)	2.50	2.65	4.00	3.95	2.98	2.80	2.68	2.95	2.85	(a)
14	(a)	(a)	2.52	2.65	4.35	3.90	2.95	2.80	2.68	2.95	2.85	(a)
15	(a)	(a)	2.56	2.65	4.44	3.85	2.91	2.82	2.68	2.95	2.85	(a)
16	(a)	(a)	2.61	2.62	4.38	3.75	2.90	2.85	2.68	2.95	2.85	(a)
17	(a)	(a)	2.60	2.60	4.32	3.80	2.87	2.98	2.67	2.93	2.85	(a)
18	(a)	(a)	2.58	2.60	4.55	3.78	2.86	3.00	2.68	2.91	2.85	(a)
19	(a)	(a)	2.60	2.61	4.70	3.74	2.83	2.96	2.68	2.91	2.85	(a)
20	(a)	(a)	2.60	2.61	4.70	3.68	2.82	2.85	2.70	2.91	2.85	(a)
21	(a)	(a)	2.58	2.59	4.70	3.61	2.82	2.80	2.82	2.90	2.85	(a)
22	(a)	(a)	2.45	2.59	4.55	3.59	2.80	2.78	2.82	2.90	2.85	(a)
23	(a)	(a)	2.45	2.59	5.15	3.58	2.79	2.75	2.89	2.90	2.85	(a)
24	(a)	(a)	2.45	2.59	5.35	3.58	2.79	2.80	2.89	2.90	2.85	(a)
25	(a)	(a)	2.42	2.59	5.15	3.55	2.96	2.79	2.87	2.90	2.83	(a)
26	(a)	(a)	2.41	2.69	4.78	3.38	2.84	2.79	2.86	2.90	2.80	(a)
27	(a)	(a)	2.48	2.69	4.45	3.31	2.80	2.82	2.85	2.90	2.77	(a)
28	(a)	2.80	2.50	2.73	4.33	3.29	2.80	2.85	2.84	2.90	2.77	(a)
29	(a)	2.73	2.68	2.84	4.30	3.20	2.92	2.86	2.80	2.90	2.75	(a)
30	(a)	.....	2.65	2.86	4.18	3.20	2.87	2.84	2.80	2.90	2.75	(a)
31	(a)	.....	2.60	.....	4.12	.....	2.83	2.88	.....	2.90	.....	(a)

a River frozen over.

Rating table for Uinta River at Fort Duchesne, Utah, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.40	44	2.85	167	3.60	523	4.50	1,210
2.45	55	2.90	184	3.70	586	4.60	1,297
2.50	67	2.95	201	3.80	653	4.70	1,385
2.55	80	3.00	219	3.90	724	4.80	1,475
2.60	93	3.10	259	4.00	799	4.90	1,565
2.65	107	3.20	304	4.10	878	5.00	1,655
2.70	121	3.30	353	4.20	959	5.10	1,745
2.75	136	3.40	406	4.30	1,041	5.20	1,835
2.80	151	3.50	463	4.40	1,125	5.30	1,930

The above table is applicable only for open-channel conditions. It is based upon 19 discharge measurements made during 1904 and is well defined. In the preparation of this table measurements made at the new or 1904 wading section and measurements at the bridge using 5-foot verticals have been discarded.

Estimated monthly discharge of Uinta River at Fort Duchesne, Utah, for 1904.

[Drainage area, 672 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March	130	46	89.3	5,491	0.133	0.153
April	170	67	99.0	5,891	.147	.164
May	1,980	161	966	59,400	1.44	1.66
June	918	304	627	37,310	.933	1.04
July	304	148	207	12,730	.308	.355
August	219	93	149	9,162	.222	.256
September	181	107	137	8,152	.204	.228
October	215	145	182	11,190	.271	.312
November	184	136	168	9,997	.250	.279
December 1–3	127	121	123	732	.183	.020
The period				160,100		

UINTA RIVER AT OURAY SCHOOL, UTAH.

This station was established November 8, 1899, by C. C. Babb. It is located at the highway bridge 5 miles below the station at Fort Duchesne. The original gage was a vertical 1 by 5 inch board, 9 feet long, nailed to the east side of the south crib of the bridge. On April 20, 1904, a new gage rod was installed on the north crib, the zero of which is 1 foot below the datum of the old gage. It is read twice each day by O. N. Waddell, the superintendent of the school. Discharge measurements are made at high stages from the bridge and at ordinary stages by wading about 200 feet below. The initial point for soundings for the section at the bridge is the zero mark on the bridge railing. The initial point for the wading section is the first tag from the right bank on the tagged wire. The channel is curved above the bridge and is straight for 600 feet below. The right bank is high, is composed of gravel, and is not subject to overflow. The left bank is low and will overflow at high stages. The bed of the stream is rocky and is filled in with sediment during a part of the year. The central pier of the bridge divides the bridge section into two parts. Bench mark No. 1 is the center one of the line of nails driven in a cottonwood tree at the northwest corner of the bridge. Its elevation is 8.48 feet above the zero of the gage. Bench mark No. 2 is a nail in the flagstaff in the school grounds. Its elevation is 23.64 feet above the zero of the gage and 4,760 feet above sea level.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Discharge measurements of Uinta River at Ouray School, Utah, for 1904.

Date	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 18[a]	H. S. Reed	53	52	1.38	1.37	72
April 14[a]	do	56	69	1.67	1.55	115
April 20[a]	do	55	66	1.47	1.48	97
April 25[a]	Reed and Murphy	49	50	1.20	1.33	60
May 20	H. S. Reed	66	236	5.46	4.15	1,289
July 14[a]	do	64	84	1.94	1.92	163
August 17[a]	do	80	120	2.42	2.43	291
September 5[a]	do	62	68	1.59	1.65	108
October 31[a]	do	60	72	1.57	1.67	113

[a] Measurement made by wading at different section.

Mean daily gage height,[a] in feet, of Uinta River at Ouray School, Utah, for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.[b]
1	.....	1.42	1.90	3.78	2.45	1.65	2.01	1.80	1.70	1.43
2	.....	1.50	1.93	3.68	2.40	1.60	2.09	1.80	1.70	1.42
3	.....	1.48	1.98	3.55	2.30	1.50	1.72	1.79	1.68	1.44
4	.....	1.40	1.98	3.26	2.30	1.50	1.88	1.80	1.62	1.49
5	.....	1.40	1.86	3.10	2.25	1.45	1.78	1.78	1.62	1.52
6	.....	1.35	1.76	3.08	2.20	1.40	1.69	1.79	1.61	1.55
7	.....	1.38	1.78	3.15	2.25	1.40	1.61	1.81	1.60	1.58
8	.....	1.32	1.82	3.35	2.35	1.35	1.58	1.78	1.60	1.71
9	.....	1.30	1.91	3.46	2.30	1.40	1.51	1.80	1.64	1.80
10	.....	1.28	2.39	3.49	2.15	1.25	1.52	1.79	1.55	.....
11	.....	1.40	2.80	3.50	2.00	1.70	1.50	1.82	1.58	.....
12	.....	1.42	3.48	3.50	2.00	1.50	1.48	1.81	1.52	.....
13	.....	1.42	3.68	3.48	2.00	1.40	1.51	1.80	1.52	.....
14	.....	1.50	4.02	3.40	1.90	2.35	1.49	1.81	1.52	.....
15	1.32	1.50	4.35	3.40	1.80	1.70	1.52	1.80	1.52	.....
16	1.35	1.50	4.15	3.40	1.80	2.15	1.52	1.80	1.51	.....
17	1.30	1.40	4.25	3.39	1.80	1.95	1.52	1.80	1.49	.....
18	1.30	1.40	4.65	3.08	1.70	2.19	1.52	1.80	1.43	.....
19	1.30	1.40	4.50	3.00	1.65	2.20	1.52	1.79	1.43	.....
20	1.30	1.46	4.50	3.00	1.60	1.99	1.50	1.80	1.42	.....
21	1.30	1.47	4.25	3.00	1.60	2.15	1.51	1.80	1.40	.....
22	1.30	1.42	4.00	2.95	1.60	1.76	1.68	1.80	1.40	.....
23	1.30	1.36	4.65	2.85	1.55	1.70	1.90	1.79	1.40	.....
24	1.32	1.32	5.25	2.75	1.65	1.78	1.78	1.77	1.41	.....
25	1.30	1.31	4.90	2.65	1.90	1.99	1.77	1.75	1.40	.....
26	1.30	1.30	4.40	2.60	1.70	1.78	1.72	1.72	1.43	.....
27	1.35	1.42	4.00	2.50	1.60	1.90	1.76	1.72	1.50	.....
28	1.45	1.49	3.90	2.45	1.60	1.95	1.71	1.72	1.40	.....
29	1.58	1.82	4.00	2.45	1.80	1.98	1.73	1.70	1.41	.....
30	1.45	1.90	3.90	2.35	1.75	1.90	1.78	1.70	1.41	.....
31	1.40	.....	3.80	.....	1.70	1.96	.....	1.70	.....	.....

[a] Gage heights referred to new datum.

[b] Ice during December.

Rating table for Uinta River at Ouray School, Utah, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.25	58	1.85	154	2.90	452	4.10	1,240
1.30	64	1.90	164	3.00	495	4.20	1,340
1.35	70	1.95	174	3.10	540	4.30	1,440
1.40	77	2.00	184	3.20	590	4.40	1,540
1.45	84	2.10	206	3.30	640	4.50	1,650
1.50	92	2.20	230	3.40	700	4.60	1,760
1.55	100	2.30	256	3.50	760	4.70	1,870
1.60	108	2.40	284	3.60	830	4.80	1,980
1.65	117	2.50	313	3.70	900	4.90	2,090
1.70	126	2.60	344	3.80	980	5.00	2,210
1.75	135	2.70	377	3.90	1,060	5.10	2,330
1.80	144	2.80	413	4.00	1,150	5.20	2,450

The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements made during 1904. It is not well defined. The table has been extended above gage height 4.15 feet.

Estimated monthly discharge of Uinta River at Ouray School, Utah, for 1904.

[Drainage area, 967 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March 15–31	105	64	70.5	2,377	0.073	0.046
April	164	62	83.2	4,951	.086	.096
May	2,510	137	972	59,770	1.01	1.16
June	964	270	577	34,330	.597	.666
July	298	100	174	10,700	.180	.208
August	270	58	141	8,670	.146	.168
September	204	89	120	7,140	.124	.138
October	148	126	140	8,608	.145	.167
November	126	77	94.7	5,635	.098	.109
The period				142,200		

WHITEROCKS RIVER NEAR WHITEROCKS, UTAH.[a]

This station was established September 15, 1899, by C. C. Babb. It is located at the mouth of the canyon at the foot of the "dug way" leading to the river bottom from the plateau above. It is 10 miles above the Indian agency at Whiterocks, which is the nearest settlement. The gage is an inclined 2 by 4 inch timber, 12 feet long, bolted to the triple trunk of a tree on the left bank 200 feet below the gaging section. Discharge measurements are made at high stages by means of a cable and car located 200 feet above the gage rod. At ordinary stages measurements are made by wading. The initial point for soundings is the tree to which the cable is fastened on the right bank. The channel is straight for 150 feet above and for 300 feet below the cable. The current is swift. Both banks are of medium height and are covered with a thick growth of trees and underbrush. The bed of the stream is rough and rocky and is covered with large bowlders. The bed is permanent, but it is hard to get accurate soundings on account of its roughness. The bench mark is a nail in a burnt aspen tree 50 feet east of the gage. Its elevation is 10.12 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Discharge measurements of Whiterocks River near Whiterocks, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 16	H. S. Reed	28.0	1.32	0.55	37
April 24	do	28.0	1.57	.70	44
May 28	do	87.0	5.07	2.00	441
June 19	do	71.0	3.61	1.65	256
August 30	do	45.0	2.62	1.10	118

[a] Gage heights at this station are only observed when visits are made by the hydrographer, so daily discharge measurements will have to be obtained by interpolation.

DUCHESNE RIVER NEAR MYTON, UTAH.

This station was established October 26, 1899, by C. C. Babb. It is located at the highway bridge, on the road from Fort Duchesne to Price, Utah, 14 miles from Fort Duchesne. It is 3 miles below the mouth of Lake Creek. The gage is a vertical 2 by 5 inch timber, 12 feet long, nailed to the south side of the west abutment. It is read twice each day by H. Calvert, the storekeeper at Myton, Utah. Discharge measurements are made at all stages from the two-span highway bridge to which the gage is attached. The initial point for soundings is the extreme east end of the bridge stringer. The channel is straight for 100 feet above and for 500 feet below the bridge. The current is sluggish at ordinary stages. The right bank is high, without trees, and will not overflow. The left bank is lower than the right, is covered with underbrush and trees, and will overflow at extreme flood stages. The bed of the stream is sandy and somewhat shifting. The channel is divided into two parts by the center pier of the bridge. The bench mark is a nail in the northwest corner of the store. Its elevation is 15.72 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Discharge measurements of Duchesne River near Myton, Utah, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 10	H. S. Reed	97	392	0.84	5.30	330
June 20	do	108	786	4.78	8.20	3,756
June 21	do	107	756	4.24	7.93	3,202
July 1	do	105	638	2.63	6.90	1,685
July 25	do	105	501	1.62	6.04	814
August 31	do	103	521	1.39	5.82	724
September 1	do	102	504	1.16	5.67	586
September 25	do	97	466	.83	5.32	385
September 25	do	97	468	.77	5.32	361

Mean daily gage height, in feet, of Duchesne River near Myton, Utah, for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.29	6.37	8.45	6.95	5.72	5.65	5.30	5.28	5.29
2	.....	5.27	6.45	8.55	6.95	5.70	5.50	5.30	5.28	5.25
3	.....	5.23	6.30	8.30	6.80	5.70	5.40	5.30	5.25	5.20
4	.....	5.22	6.30	7.95	6.70	5.68	5.40	5.28	5.25	5.35
5	.....	5.25	6.34	7.85	6.60	5.60	5.36	5.28	5.25	5.30
6	.....	5.30	6.33	7.80	6.55	5.52	5.31	5.28	5.22	5.20
7	.....	5.28	6.30	8.10	6.65	5.50	5.30	5.40	5.22	.....
8	.....	5.28	6.60	8.40	6.50	5.50	5.30	5.40	5.22	.....
9	.....	5.28	6.49	8.40	6.45	5.50	5.30	5.49	5.20	.....
10	5.30	5.28	6.49	8.35	6.40	5.50	5.30	5.46	5.20	.....
11	5.27	5.34	6.80	8.65	6.25	5.75	5.25	5.44	5.20	.....
12	5.21	5.49	6.96	8.85	6.20	5.65	5.20	5.50	5.20	.....
13	5.20	5.73	7.04	8.85	6.20	5.70	5.20	5.50	5.20	.....
14	5.25	5.90	7.28	8.70	6.20	5.72	5.20	5.50	5.20	.....
15	5.26	6.01	7.49	8.60	6.10	5.75	5.20	5.48	5.20	.....
16	5.21	6.10	7.59	8.30	6.10	5.75	5.11	5.47	5.25	.....
17	5.19	6.08	7.70	8.20	6.00	5.78	5.20	5.44	5.33	.....
18	5.20	6.15	7.95	8.15	6.00	5.80	5.20	5.41	5.30	.....
19	5.21	6.21	8.14	8.00	5.91	5.70	5.20	5.35	5.25	.....
20	5.25	6.15	8.20	8.10	5.90	5.60	5.25	5.28	5.22	.....
21	5.29	6.10	8.20	7.96	5.82	5.50	5.30	5.28	5.26	.....
22	5.23	6.20	8.17	7.86	5.80	5.45	5.35	5.29	5.28	.....
23	5.20	5.93	8.65	7.69	5.70	5.40	5.40	5.30	5.29	.....
24	5.20	5.88	9.30	7.59	5.90	5.45	5.35	5.30	5.33	.....
25	5.23	5.82	9.50	7.45	6.00	5.45	5.30	5.30	5.37	.....
26	5.25	5.88	9.35	7.25	6.00	5.45	5.30	5.30	5.33	.....
27	5.21	6.06	8.95	7.15	5.85	5.48	5.30	5.30	5.29	.....
28	5.20	6.39	8.30	7.05	5.80	5.65	5.30	5.30	5.28	.....
29	5.27	6.37	8.30	7.05	5.85	5.85	5.30	5.30	5.38	.....
30	5.37	6.43	8.30	7.00	5.90	7.15	5.30	5.30	5.35	.....
31	5.33	.....	8.30	.....	5.80	6.20	.....	5.30	.....	.....

Rating table for Duchesne River near Myton, Utah, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.10	264	6.00	840	7.20	2,150	8.40	4,070
5.15	288	6.10	920	7.30	2,290	8.50	4,250
5.20	313	6.20	1,005	7.40	2,430	8.60	4,430
5.25	339	6.30	1,100	7.50	2,575	8.70	4,610
5.30	366	6.40	1,200	7.60	2,725	8.80	4,790
5.35	394	6.50	1,305	7.70	2,880	8.90	4,970
5.40	423	6.60	1,415	7.80	3,040	9.00	5,150
5.45	453	6.70	1,530	7.90	3,205	9.10	5,330
5.50	484	6.80	1,650	8.00	3,375	9.20	5,510
5.60	548	6.90	1,770	8.10	3,545	9.30	5,700
5.70	615	7.00	1,890	8.20	3,715	9.40	5,890
5.80	685	7.10	2,020	8.30	3,890	9.50	6,080
5.90	760						

The above table is applicable only for open-channel conditions. It is based upon 13 discharge measurements made during 1904. It is fairly well defined between gage heights 5.30 feet and 8.20 feet. The table has been extended above gage height 8.20 feet.

Estimated monthly discharge of Duchesne River near Myton, Utah, for 1904.

[Drainage area, 2,746 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March 10–31	406	308	335	14,620	0.122	0.100
April	1,230	323	691	41,120	.252	.281
May	6,080	1,100	2,856	175,600	1.04	1.20
June	4,880	1,890	3,454	205,500	1.26	1.41
July	1,830	615	1,031	63,390	.375	.432
August	2,085	423	623	38,310	.227	.262
September	581	269	369	21,930	.134	.150
October	484	355	401	24,660	.146	.168
November	411	313	346	20,590	.126	.141
The period				605,700		

DUCHESNE RIVER (WEST FORK) ABOVE FORKS, UTAH.

This station was established May 26, 1904, by C. Tanner. It is located 3 miles above the forks of Duchesne River. The original gage was a vertical staff, graduated to feet and tenths, driven into the bed of the stream and firmly braced. An inclined staff gage, graduated to read directly to feet and tenths, was established October 8, 1904, the datum being 0.78 feet below that of the vertical gage. Gage readings are taken about twice a week by Frank Thomas. Discharge measurements are made by means of a cable and car. The initial point for soundings is the first ring of fine wire around the cable at the right bank. The channel is straight for about 200 feet above and 100 feet below the station. The current is swift. The right bank is high, wooded, and is not liable to overflow. The left bank is low, wooded, and subject to overflow during high water. The bed of the stream is composed of clean sand, gravel, and rock, and is permanent. There is but one channel at all stages. The conditions are favorable to accurate measurements. The bench mark is the head of a one-fourth inch bolt driven into the south face of a large pine tree about 85 feet northwest of the gage rod. The tree is blazed above the bolt head, and marked "B. M. 6.56" with nails driven into the tree. Its elevation is 6.56 feet above the zero of the inclined gage and 5.78 feet above the zero of the vertical gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Duchesne River (West Fork) above forks, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 26	C. Tanner	76	4.29	1.50	327
May 30	do	67	4.07	1.30	271
June 6	F. Thomas	57	3.95	1.05	225
June 16	C. Tanner	49	3.44	.80	167
June 26	do	37	2.66	.45	98
July 12	F. Thomas	28	2.11	.20	60
July 18	do	27	1.67	.15	44
August 3	do	22	1.46	.00	32
August 16	do	21	1.40	.00	29
October 8	C. Tanner	18	1.20	—.07	21

Mean daily gage height, in feet, of Duchesne River (West Fork) above forks, Utah, for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1						
2						
3				0.00		
4						
5						
6		1.05				
7						
8						−0.07
9						
10						
11						
12			0.20			
13		1.00				
14						
15						
16		.80		.00		
17		.80				
18			.15			
19						
20						
21						
22						
23						
24				−.05		
25						
26	1.50	.45				
27						
28		.40				
29						
30	1.30		.05			
31						

DUCHESNE RIVER (NORTH FORK) ABOVE FORKS, UTAH.

This station was established May 28, 1904, by C. Tanner. It is located 1 mile above the forks of Duchesne River. The original gage was a vertical staff, graduated to feet and tenths, driven into the bed of the river near the right bank. An inclined-staff gage, reading directly to feet and tenths, was established October 6, 1904, at the same elevation as the vertical gage. The gage is read about twice a week by Frank Thomas. Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is the first metallic tag on the tagged wire at the left bank. The channel is straight for about 200 feet above and 500 feet below the station. The current is swift. The banks are not liable to overflow. The bed of the stream is composed of large bowlders, and is permanent. There is but one channel at all stages. The roughness of the stream bed gives large inaccuracies in determining depth, and endangers the meter when attempting to secure bottom velocities during high stages. Bench mark No. 1 is the "Knob" in the northeast quadrant of a cross cut in a limestone ledge about 100 feet southwest of the gage rod, marked by the words "Bench mark" chiseled into the face of the cliff to the north of the cross. Its elevation is 8.39 feet above the zero of the gage. Bench mark No. 2 is the head of a bolt driven into the root of the pine tree to which the cable and gage rods are fastened. It is marked "Bench mark 5.11." Its elevation is 5.11 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Duchesne River (North Fork) above forks, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 28	C. Tanner	148	5.18	2.50	765
June 19	do	157	5.46	2.65	860
June 26	do	119	3.50	2.00	415
July 12	F. Thomas	96	2.96	1.40	283
July 19	do	82	2.38	1.20	196
August 3	do	72	1.84	1.00	133
August 16	do	64	1.80	.95	116
October 7 [a]	C. Tanner	49	1.06	.76	52

[a] Measurement made 200 yards above cable station.

Mean daily gage height, in feet, of Duchesne River (North Fork) above forks, Utah, for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1						
2						
3				1.00		
4						
5						0.71
6		2.40				
7				.95		.76
8						
9						.74
10						
11						
12			1.40			
13		3.10		.95		
14						
15						
16				.95		
17		2.50				
18						
19		2.65	1.20			
20						
21						
22						
23						
24				.90		
25						
26	2.80	2.00				
27	2.70					
28	2.50	1.95				
29	2.50					
30			1.00			
31						

ROCK CREEK (EAST CREEK) 10 MILES ABOVE MOUTH, UTAH.

This station was established May 17, 1904, by H. S. Reed. It was originally located at the footbridge at the ford where the Indian trail up Farm Creek to Whiterocks, Utah, crosses Rock Creek, about 8½ miles above the junction of Rock Creek with the Duchesne River. A plain staff gage was fastened to the left abutment of the bridge, and discharge measurements were made from the footbridge. Bench marks for this gage were established as follows: No. 1 is a nail in the bridge stringer back of the gage rod. Its elevation is 6.33 feet above the zero of the gage. Bench mark No. 2 is the highest point on bowlder 15 feet southeast from the gage. Its elevation is 6.87 feet above the zero of the gage. Bench mark No. 3 is a nail in a stump 55 feet west of the gage rod at the west end of the bridge. Its elevation is 6.50 feet above the zero of the gage.

The station was reestablished June 21, 1904, by C. Tanner, at approximately the 7,500 foot contour, about 10 miles above the mouth

of the creek, 1½ miles above the original location. The new gage is a plain staff, graduated to feet and tenths, driven into the bed of the stream and firmly braced. It is read twice each week by Frank Thomas. Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is the first metal tag on the tagged wire at the left bank. The channel is straight for 500 feet above and 400 feet below the station. The current is swift. The right bank is low, and liable to overflow during high water. The left bank is high, rocky, and not subject to overflow. The bed of the stream is composed of rock, free from vegetation, and is permanent. There is but one channel at all stages. The chief inaccuracy is developed by the uneven bed. No bench marks have as yet been established for the new gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Rock Creek (East Creek) 10 miles above mouth, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 17	H. S. Reed	89	6.47	2.80	576
May 18	do	104	7.35	3.20	746
June 21	C. Tanner	232	4.00	3.60	929
June 25	do	206	3.04	3.25	625
July 20	F. Thomas	135	1.79	2.50	241
August 14	do	128	1.32	2.20	169
September 26	C. Tanner	100	.85	2.11	85
October 4	do	100	.73	2.07	73

Mean daily gage height, in feet, of Rock Creek (East Creek) 10 miles above mouth, Utah, for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1						17	2.80					
2						18	3.20					
3						19		3.80				
4					2.07	20		3.60	2.50			
5				2.15	2.07	21		3.60				
6						22						
7						23				2.20		
8						24						
9						25		3.25				
10						26					2.11	
11						27						
12						28						
13						29						
14			2.20			30						
15						31				2.20		
16												

STRAWBERRY RIVER IN STRAWBERRY VALLEY, UTAH.

This station was established May 12, 1903, by C. Tanner. The original gage was a vertical staff, graduated to feet and tenths, driven into the bed of the river 100 feet below the junction of Big and Little Strawberry rivers. A new gage was installed June 2, 1904, one-half mile below the junction. It is a vertical staff, graduated to feet and tenths, driven into the bed of the river and securely braced. The gage is read twice a week by Frank Thomas. Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is the first metal tag on the tagged wire at the left bank. The channel is straight for about 600 feet above and 400 feet below the station. The current is sluggish. Both banks are wooded and not liable to overflow. The bed of the stream is composed of gravel, somewhat moss-grown, and permanent. There is but one channel at all stages. The vegetation in the bed of the stream may affect both gage heights and gagings at low water. No bench marks have been established, but the relation between the two gages has been established by simultaneous readings.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Strawberry River in Strawberry Valley, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 22	C. Tanner	108	3.88	2.95	420
June 1	do	84	3.06	2.25	257
June 10	F. Thomas	86	1.64	(2.20) 1.80	141
June 15	C. Tanner	78	1.67	(1.97) 1.50	131
June 28	do	61	1.31	(1.75) 1.17	79
July 9	F. Thomas	61	1.07	(1.75) 1.00	64
July 17	do	60	.93	(1.75) .95	56
August 26	do	30	1.17	(1.95) .95	35
September 22	C. Tanner	26	1.03	.98	27

NOTE.—Gage heights in parentheses are taken from the new gage rod at cable section, which are of no value in season of growing moss, as gage reading does not fall as creek diminishes in volume.

Estimated monthly discharge[a] of Strawberry Creek in Strawberry Valley, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	27	27	27	1,660
February	27	27	27	1,553
March	27	27	27	1,660
April	224	27	97	5,771
May	472	230	372	22,870
June	257	74	145	8,627
July	74	48	58	3,566
August	48	34	40	2,459
September	33	27	29	1,725
October	27	27	27	1,660
November	27	27	27	1,606
December	27	27	27	1,660
The year	472	27	75	54,820

[a] Estimated by C. Tanner from meter measurements, interpolated gage heights, and temperature records.

CURRANT CREEK 13 MILES ABOVE MOUTH, UTAH.

This station was established May 23, 1904, by C. Tanner. It is located 13 miles above the junction of Deep and Currant creeks. A plain staff gage graduated to feet and tenths is driven into the bed of the stream. It is read twice each week by Frank Thomas. Discharge measurements are made by wading near the gage. The initial point for soundings is the first tag of the tagged wire at the left bank. The channel is straight for about 150 feet above and 80 feet below the station. The current is swift. The banks of the stream are about 2 feet high, covered with willows, and are liable to overflow. The bed of the stream is composed of bowlders and gravel. It is rough and permanent. There is but one channel at all stages.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Currant Creek 13 miles above mouth, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 23	C. Tanner	62	3.02	2.80	186
September 24	do	11	.68	.90	8

CURRANT CREEK 3 MILES ABOVE MOUTH, UTAH.

This station was established April 4, 1904, by C. Tanner. It is located at the road crossing 3 miles above the junction of Deep and Currant creeks. A plain staff gage, graduated to feet and tenths, is driven firmly into the bed of the stream and securely braced. It is read twice each week by Frank Thomas. Discharge measurements are made by wading near the gage. The initial point for soundings is a blazed stake driven into the left bank about 15 feet below the gage rod. The channel is straight for about 200 feet above and 75 feet below the station. The current is swift. The right bank is wooded and overflows only during extremely high water. The left bank is high, wooded, and not subject to overflow. The bed of the stream is composed of coarse gravel, free from vegetation, and is liable to shift at high water. There is but one channel at all stages.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Currant Creek 3 miles above mouth, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
April 4	C. Tanner	17	1.90	1.43	32
May 23	do	52	3.87	2.33	202
May 31	do	45	3.57	2.13	159
June 16	do	33	2.83	1.88	94
June 27	do	28	2.29	1.70	65
July 11	F. Thomas	22	2.10	1.50	46
August 4	do	16	1.40	1.35	23
September 25	C. Tanner	16	1.03	1.37	16

Mean daily gage height, in feet, of Currant Creek 3 miles above mouth, Utah, for 1904.

Day.	Apr.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1						17					
2						18					
3						19					
4	1.43			1.35		20					
5						21			1.45		
6						22					
7						23	2.33				
8						24					1.38
9						25					1.37
10			1.50			26				1.30	
11			1.50			27		1.70			
12						28		1.70			
13						29					
14			1.50			30					
15						31	2.13				
16		1.88									

LAKE FORK (WEST FORK) 10 MILES ABOVE FORKS, UTAH.

This station was established May 16, 1904, by H. S. Reed. It is located at the outlet of the lower lake on the West Fork, 10 miles above the forks of Lake Fork. It is at approximately the 8,500-foot contour. Whiterocks Indian Agency, the nearest post-office, is about 50 miles distant. Fort Duchesne is about 50 miles to the southeast. The original gage was a vertical staff driven into the bed of the stream and braced to a pine tree on the right bank. An inclined staff gage, reading directly to feet and tenths, was established September 30, 1904, by C. Tanner, at the same elevation as the vertical gage. The gage is read by Frank Thomas. Discharge measurements are made by means of a cable, car, and tagged wire at ordinary stages and by wading during low water. The channel is straight for 300 feet above and 150 feet below the station. The current is sluggish above and swift below the station. Both banks are high, wooded, and not liable to overflow. The bed of the stream is rocky, free from vegetation, and permanent. There is but one channel at all stages. Bench mark No. 1 is the head of a one-fourth inch bolt driven into the north side of the red pine tree which forms the cable support on the right bank. The tree is blazed above the bolt and marked "U. S. G. S. Gage B. M. 8.43." Its elevation is 8.43 feet above the zero of the gage. Bench mark No. 2 is the head of a 30-penny nail driven into the root of a pine tree 45 feet south of bench mark No. 1. Its elevation is 4.25 feet above the zero of the gage. Bench mark No. 3 is the head of a 30-penny nail 2 feet above the ground, driven into the east side of a pine tree 25 feet west of bench mark No. 1. It is marked

"U. S. G. S. B. M. Elevation, 10.38." Its elevation is 10.38 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Lake Fork (West Fork) 10 miles above forks, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 16	H. S. Reed	155	1.99	2.30	309
June 29	do	156	2.20	2.33	344
September 1	F. Thomas	97	1.21	1.35	117
September 29	C. Tanner	66	.85	1.10	56

NOTE.—For measurements made of a small creek entering the lake above the station see miscellaneous measurements.

LAKE FORK (EAST FORK) 8 MILES ABOVE FORKS, UTAH.

This station was established May 14, 1904, by H. S. Reed. It is located 8 miles above the forks of Lake Fork, 1 mile below the upper Indian camp on the East Fork, at approximately the 7,500-foot contour. Whiterocks Indian Agency, the nearest post-office, is about 40 miles distant, and Fort Duchesne is about 45 miles to the northeast. The original gage was a plain staff driven into the bed of the stream and braced to an overhanging stump on the left bank. An inclined gage, reading directly to feet and tenths, was established October 2, 1904, by C. Tanner, at the same elevation as the vertical gage. The gage is read by Frank Thomas. Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is the first metal tag on the tagged line at the right bank. The channel is straight for about 300 feet above and 200 feet below the station. The current is swift. The right bank is low, wooded, and liable to overflow during high water. The left bank is high, wooded, and not subject to overflow. The bed of the stream is composed of bowlders, free from vegetation, and permanent. There is but one channel at all stages. Bench mark No. 1 is a bolt in the cable post on the right bank. Its elevation is 3.49 feet above the zero of the gage. Bench mark No. 2 is a cross chiseled in a large bowlder near the left end of the cable. It has an elevation of 6.39 feet above the zero of the gage, and is marked "U. S. G. S. B. M. 6.39." Bench mark No. 3 is the head of a 30-penny nail driven into the sawed stump of an aspen on the left bank. Its elevation is 8.52 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Lake Fork (East Fork) 8 miles above forks, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 14 [a]	H. S. Reed	91	2.91	1.40	265
June 28 [a]	do	94	2.72	1.31	256
October 2	C. Tanner	64	1.33	.68	86

[a] Measurement made by wading.

LAKE FORK BELOW FORKS, UTAH.

This station was established June 23, 1904, by C. Tanner. It is located just below the forks of Lake Fork, on the trail from Spanish Fork to Whiterocks, Utah. A plain staff gage, graduated to feet and tenths, is driven vertically into the bed of the stream and securely braced. It is read twice a week by Frank Thomas. Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is the first metal tag on the tagged wire at the left bank. The channel is straight for about 400 feet above and below the station. The current is swift. The right bank is low, wooded, and liable to overflow during high water. The left bank is high, wooded, and is not subject to overflow. The bed of the stream is composed of large bowlders, free from vegetation, and is somewhat shifting. There is but one channel at all stages. The conditions are unfavorable to accurate measurement, but are the best that could be found.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Lake Fork below forks, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
June 24	C. Tanner	153	5.06	2.00	772
July 20	F. Thomas	109	3.38	1.00	369
August 14	do	106	3.34	1.00	355
September 1	do	96	2.93	.85	283
September 28	C. Tanner	70	2.38	.65	168

LAKE FORK NEAR ITS MOUTH, UTAH.

This station was established July 3, 1900, by C. T. Prall. It is located at the wagon bridge one-half mile above the mouth of the creek. It is 3 miles from the gaging station on Duchesne River at Price Road bridge and is 17 miles southwest of Fort Duchesne. The gage is a 1 by 4 inch vertical board, 9 feet long, nailed to the downstream side of the west abutment. During 1904 all discharge measurements were made from the bridge. There is a section 400 feet below the bridge at which measurements may be made by wading. The initial point for soundings is a point marked on the bridge floor at the edge of the east abutment on the right bank. The channel is straight for 75 feet above and for 200 feet below the station. The current is never swift except during flood stages. Both banks are high and are not subject to overflow. The bed of the stream is composed of cobblestones and there is but one channel at all stages. Bench mark No. 1 is a nail in the bridge abutment opposite the 4.5-foot mark on the gage rod. Bench mark No. 2 is a nail in the bridge upright directly over the gage rod. Its elevation is 10.59 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of H. S. Reed, resident hydrographer.

Discharge measurements of Lake Fork near its mouth, Utah, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 10	H. S. Reed	40	124	0.52	1.80	64
April 21	do	40	135	1.22	2.20	165
April 22	Reed and Murphy	40	138	1.13	2.15	156
May 19	H. S. Reed	40	234	4.80	4.30	1,123
June 20	do	40	247	4.98	4.32	1,230
June 21	do	40	234	4.78	4.15	1,119
July 1	do	40	182	3.31	3.25	603
July 25	do	40	154	2.10	2.60	324
August 31	do	40	160	2.44	2.80	391
August 31	do	40	143	2.09	2.60	299
September 26	do	40	134	1.28	2.23	171

RED CREEK ABOVE NARROWS, UTAH.

This station was established May 31, 1904, by C. Tanner. It is located above the narrows of Red Creek, about 10 miles above the point where the wagon road from Heber City to Fort Duchesne crosses Red Creek. A plain staff gage, graduated to feet and tenths, is driven into the bed of the stream and firmly braced. It is read twice a week by Frank Thomas.

Discharge measurements are made by wading near the gage. The initial point for soundings is a blazed stake on the left bank, to which one end of the tagged wire is fastened when the stream is gaged. The channel is straight for 35 feet above and 25 feet below the station. The current is sluggish above and swift below the station. Both banks are low, covered with a willow growth, and liable to overflow during high water. The bed of the stream is composed of clean sand and gravel and is fairly permanent. There is but one channel at all stages.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Red Creek above narrows, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean Velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 31	C. Tanner	15	1.80	2.40	27
June 6	F. Thomas	12	2.02	1.95	24
October 12	do	1.5	1.12	.60	2

PRICE RIVER NEAR HELPER, UTAH.

This station was established February 21, 1904, by Caleb Tanner. It is located on the upper side of the ford, near the settlement of Spring Glen, about 2½ miles south of the town of Helper, Utah, and about 350 feet west of the main line of the Denver and Rio Grande Railroad. A plain staff gage, graduated to feet and tenths, is driven vertically into the bed of the river. It is read once each day by Perry Miller. Discharge measurements are made by wading. The initial point for soundings is a 2 by 4 inch post driven into the slope of the left bank, south 8° west 21½ feet from the gage. The course of the section is north 44° west. At 71 feet on the section a 2 by 4 inch post is driven on the west bank of the river. The channel is straight for 125 feet above and 400 feet below the station. The current is swift. The right bank is a low, sloping bank of clay and sand. The left bank is high at the station, but 30 feet below turns away from the river, leaving a large area of low ground that is mostly covered during high water. The bed of the stream is composed of clean gravel and sand and fairly permanent, except near the east bank, where it is liable to shift. There is one channel at all stages. During extreme high water discharge measurements may have to be taken at the footbridge. Bench mark No. 1 bears south 65° east 23 feet from the gage, being a United States Geological Survey standard bench-mark cap set in cement on a sandstone bowlder embedded in the sloping bank, about 16 feet below the center of a small ditch. Its elevation is 12.55 feet above the zero of the gage, and is so marked upon the cap. Bench mark No. 2 bears south 86° east 19.2 feet from the gage, being a cross

chiseled on the sloping face of a large bowlder embedded in the sloping bank and marked "B. M." Its elevation is 11.19 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Price River near Helper, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
February 20	C. Tanner	23	1.08	3.33	25
April 1	W. P. Hardesty	45	1.51	3.63	68
June 11	W. Swendsen	105	2.55	4.32	268
September 2	C. Tanner	29	.94	3.43	27
December 6	W. Swendsen	3.3	1.41	3.20	5

Mean daily gage height, in feet, of Price River near Helper, Utah, for 1904.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.63	3.65	4.30	.....	3.75	3.50	3.50	3.40	3.35	3.40
2	.....	3.53	3.60	4.20	.....	3.75	3.55	3.50	3.40	3.35	3.40
3	.....	3.43	3.61	4.32	.....	3.75	3.45	3.50	3.40	3.30	3.40
4	.....	3.50	3.60	4.25	.....	3.65	3.45	3.50	3.40	3.30	3.40
5	.....	3.40	3.70	4.30	.....	3.65	3.45	3.50	3.40	3.30	3.40
6	.....	3.50	3.70	4.35	.....	3.65	3.45	3.50	3.40	3.30	3.40
7	.....	4.50	3.60	4.60	.....	3.60	3.45	3.60	3.40	3.30	3.30
8	.....	3.60	3.70	4.60	.....	3.70	3.45	3.50	3.40	3.30	3.25
9	.....	3.40	3.80	4.70	.....	3.60	3.40	3.50	3.40	3.30	3.30
10	.....	3.50	3.90	4.85	.....	3.55	3.40	3.50	3.45	3.30	3.30
11	.....	3.50	4.20	4.90	[b] 4.30	3.50	3.40	3.50	3.50	3.30	3.30
12	.....	3.40	4.10	4.60	4.30	3.50	3.45	3.50	3.60	3.30	3.25
13	.....	3.40	4.10	4.60	4.25	3.55	3.55	3.50	3.50	3.30	3.25
14	.....	3.50	4.20	4.65	4.20	3.50	3.55	3.55	3.45	3.30	3.25
15	.....	3.40	4.40	4.70	4.20	3.55	3.55	3.50	3.50	3.30	3.25
16	.....	3.40	4.10	4.70	4.15	3.50	3.45	3.50	3.45	3.40	3.25
17	.....	3.40	4.10	4.70	4.15	3.50	3.50	3.45	3.45	3.45	3.25
18	.....	3.50	4.10	4.75	4.15	3.50	3.60	3.40	3.40	3.40	3.25
19	.....	3.50	4.20	4.70	4.00	3.50	3.40	3.45	3.40	3.40	3.30
20	3.33	3.60	4.30	4.60	4.15	3.50	3.40	3.40	3.40	3.40	3.30
21	3.32	3.40	4.10	4.55	4.00	3.50	3.45	3.55	3.40	3.40	3.30
22	3.33	3.60	4.00	4.50	3.95	3.50	3.40	3.40	3.40	3.40	3.30
23	3.33	3.40	4.00	4.50	3.95	3.55	3.40	3.25	3.40	3.40	3.30
24	3.45	3.60	3.90	4.60	4.00	3.50	3.45	3.40	3.40	3.40	3.30
25	3.42	3.60	3.90	([a])	3.95	3.50	3.45	3.40	3.40	3.40	3.30
26	3.60	3.50	4.00	.....	3.95	3.50	3.45	3.40	3.35	3.40	3.30
27	3.53	3.40	4.00	.....	3.85	3.50	[c] 3.55	3.40	3.35	3.40	3.40
28	3.63	3.50	4.10	.....	3.85	3.55	3.50	3.45	3.35	3.40	3.40
29	3.60	3.60	4.00	.....	3.75	3.60	3.50	3.40	3.35	3.40	3.40
30	.....	3.60	4.20	.....	3.74	3.55	3.50	3.40	3.35	3.40	3.35
31	.....	3.60	.....	.....	.....	3.55	3.50	.....	3.35	.....	3.30

[a] Gage washed out.
[b] Gage replaced.
[c] Flood of four hours' duration this day; average gage height 8 feet; maximum gage height 3.50

Rating table for Price River near Helper, Utah, from February 20 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.20	5	3.60	63	4.00	172	4.60	346
3.25	9	3.65	74	4.05	186	4.70	375
3.30	14	3.70	87	4.10	201	4.80	404
3.35	20	3.75	100	4.15	215	4.90	433
3.40	27	3.80	114	4.20	230	5.00	462
3.45	35	3.85	128	4.30	259	6.00	752
3.50	44	3.90	143	4.40	288	7.00	1,042
3.55	53	3.95	157	4.50	317	8.00	1,332

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is well defined between gage heights 3.20 feet and 3.70 feet. The table has been extended above gage height 4.30 feet. Above gage height 3.90 feet the rating curve is a tangent determined by one measurement at 4.30 gage height, the difference being 29 per tenth.

Estimated monthly discharge of Price River near Helper, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February 20–29	70	16	38.0	754
March	70	27	44	2,705
April	288	63	162	9,640
May 1–24	433	230	335	15,950
June 11–30	259	97	183	7,259
July	100	44	57.6	3,542
August	63	27	38.7	2,380
September	63	9	38.1	2,267
October	63	20	29.5	1,814
November	35	14	21.2	1,262
December	63	9	17.8	1,094
The period				48,670

GRAND RIVER (NORTH FORK) NEAR GRAND LAKE, COLO.

This station was established July 29, 1904, by M. C. Hinderlider. It is located at the highway bridge on the road between Grand Lake and Hot Sulphur Springs, and about 3 miles south of Grand Lake post-office, Colo. The nearest railroad is the Colorado and Southern at Georgetown, Colo., distant by road 70 miles. A plain staff gage, grad-

uated to feet and tenths, is attached vertically to the downstream edge of the right abutment. The gage reads from 2 to 10.3 feet, the 2-foot mark resting on the bed of the stream. The gage is read twice each day by Robert C. Graves. Discharge measurements are made at higher stages from the downstream side of the single-span bridge, to which the gage is attached, sounding points being marked and numbered every 2 feet from zero to 40 feet on the downstream side of the bridge. At low water measurements are made by wading at convenient points. The initial point for soundings is a 10-penny nail driven into the bridge floor over the north face of the right abutment, and marked "0" with black paint. The channel is straight for about 500 feet above and for 150 feet below the station. The channel is very rough and has a great fall, being a typical mountain stream. Both banks are about 2 feet high, covered with a heavy sod, willows, and scattering pine trees. They do not overflow except at exceedingly high stages, and then only along the edges. The bed of the stream is rough, being composed of large and small cobblestones and scattering large bowlders. The great velocity of the current during high water and the presence of large bowlders, which break the evenness of the channel, may affect the accuracy of measurements. The bed of the channel is smoother at the station than either above or below. This is the only point available for measurements, and is probably the best that could be had. Bench mark No. 1 is a 10-penny nail driven into a notch cut in the northeast root of a 12-inch pine tree, which stands at the right end of the bridge on the downstream side. Its elevation is 8.36 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Mean daily gage height, in feet, of Grand River (North Fork) near Grand Lake, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	.....	4.25	4.10	3.60	17	.....	3.90	3.60	3.55
2	.....	4.00	4.32	3.60	18	.....	3.98	3.68	3.55
3	.....	4.00	3.98	3.60	19	.....	3.95	3.60	3.52
4	.....	3.92	3.90	3.58	20	.....	3.90	3.60	3.52
5	.....	3.90	3.80	3.55	21	.....	4.10	3.60	3.50
6	.....	3.90	3.80	3.55	22	.....	3.98	3.60	3.58
7	.....	3.85	3.75	3.55	23	.....	3.92	3.68	3.60
8	.....	3.80	3.70	3.58	24	.....	3.80	3.62	3.58
9	.....	3.80	3.70	3.62	25	.....	3.80	3.60	3.52
10	.....	3.80	3.70	3.70	26	.....	3.80	3.68	3.50
11	.....	3.80	3.70	3.62	27	.....	3.85	3.62	3.50
12	.....	3.85	3.65	3.60	28	.....	4.05	3.60	3.50
13	.....	3.80	3.60	3.60	29	4.20	3.92	3.60	3.50
14	.....	3.82	3.60	3.60	30	4.15	3.88	3.60	3.50
15	.....	3.80	3.60	3.60	31	4.30	3.80	.....	3.48
16	.....	3.85	3.60	3.55					

Discharge measurements of Grand River (North Fork) near Grand Lake, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 29	W. A. Lamb	40	89	2.00	4.12	178
August 15	do	39	64	1.11	3.81	71
September 1	do	39	82	1.51	4.12	124
October 5	do	39	54	.72	3.55	39

Rating table for Grand River (North Fork) near Grand Lake, Colo., from July 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.45	30	3.70	59	3.95	96	4.15	133
3.50	35	3.75	66	4.00	104	4.20	144
3.55	41	3.80	73	4.05	113	4.25	156
3.60	47	3.85	80	4.10	123	4.30	170
3.65	53	3.90	88				

The above table is applicable only for open-channel conditions. It is based upon 3 discharge measurements made during 1904.

Estimated monthly discharge of Grand River (North Fork) near Grand Lake, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
August	156	73	88.2	5,423
September	176	47	62.1	3,695
October	59	33	42.3	2,600

GRAND LAKE OUTLET NEAR GRAND LAKE, COLO.

This station was established July 31, 1904, by M. C. Hinderlider. It is located at the footbridge at the lower end of Grand Lake and about one-half mile south of Grand Lake post-office, Colo. The nearest railroad is the Colorado and Southern at Georgetown, Colo., distant by road about 70 miles. A plain staff gage, graduated to feet and tenths, is attached vertically to the southeast corner of the second pier from the north end of the bridge, the 2-foot mark resting on the

bed of the stream. It is read twice each day by J. W. Davies. Discharge measurements are made during ordinary stages by wading at a ford about one-fourth mile below the gage. At high stages measurements will be made by means of a boat and cable, which will be installed in the spring of 1905. The channel is straight for about 300 feet above and for 150 feet below the station, and the current is swift. Both banks at the measuring point are about 3 feet high, steep, and the level tops are covered with spruce trees. The left bank at the gage is low, flat, and clean for a short distance back from the water's edge, after which it rises above the high-water line. Both banks are subject to overflow. The bed of the stream at the outlet is composed of coarse gravel and large bowlders, and the current is badly broken. At the point where discharge measurements are made the bed is composed of gravel and cobblestones and is uniform, clean, and permanent. The swiftness of the current at high stages may affect the accuracy of the measurements. At ordinary stages excellent results may be secured. Bench mark No. 1 is a cross made with black paint on the top of a large granite bowlder, 85 feet south of the left bank of the outlet and 40 feet west from the lake. It is marked with black paint "U. S. G. S. B. M." Its elevation is 12.05 feet above the zero of the gage. Bench mark No. 2 is a cross cut into the top of a granite bowlder at station 1,198 feet from the initial point for soundings and marked "B. M." Its elevation is 14.93 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Grand Lake outlet near Grand Lake, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft per sec.*	*Feet.*	*Sec.-feet.*
July 30	W. A. Lamb	150	184	0.95	2.40	174
August 15	do	50	53	1.62	2.08	86
September 1	do	51	63	2.08	2.23	131
October 5 [a]	do	43	36	1.22	1.78	44

[a] By wading.

Mean daily gage height, in feet, of Grand Lake outlet near Grand Lake, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.30	2.23	1.78	1.55	17	.....	2.04	1.74	1.70	1.34
2	.....	2.26	2.40	1.80	1.54	18	.....	2.16	1.74	1.70	1.33
3	.....	2.24	2.34	1.80	.....	19	.....	2.28	1.74	1.68	1.32
4	.....	2.19	2.24	1.78	.....	20	.....	2.27	1.73	1.69	1.32
5	.....	2.16	2.15	1.78	.....	21	.....	2.30	1.73	1.68	1.31
6	.....	2.13	2.08	1.76	.....	22	.....	2.30	1.72	1.68	1.30
7	.....	2.09	2.02	1.74	.....	23	.....	2.21	1.72	1.68	1.30
8	.....	2.06	1.97	1.74	.....	24	.....	2.14	1.73	1.66	1.29
9	.....	2.04	1.93	1.75	.....	25	.....	2.10	1.72	1.66	1.28
10	.....	2.02	1.89	1.80	1.44	26	.....	2.07	1.70	1.64	1.27
11	.....	2.01	1.86	1.78	1.42	27	.....	2.04	1.72	1.64	.....
12	.....	2.01	1.86	1.78	1.40	28	.....	2.10	1.72	1.62	.....
13	.....	2.02	1.84	1.78	1.38	29	.....	2.14	1.71	1.62	.....
14	.....	2.04	1.82	1.74	1.36	30	2.40	2.14	1.72	1.60	.....
15	.....	2.04	1.78	1.74	1.36	31	2.38	2.11	.....	1.57	.....
16	.....	2.04	1.76	1.72	1.34						

Rating table for Grand Lake outlet near Grand Lake, Colo., from July 30 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.55	21	1.80	47	2.05	91	2.25	136
1.60	25	1.85	54	2.10	102	2.30	148
1.65	29	1.90	62	2.15	113	2.35	160
1.70	34	1.95	71	2.20	124	2.40	173
1.75	40	2.00	81				

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904. It is fairly well defined between gage heights 1.80 feet and 2.40 feet. The table has been extended below gage height 1.80 feet.

Estimated monthly discharge of Grand Lake outlet near Grand Lake, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
August	148	83	109	6,702
September	173	34	63.7	3,790
October	47	23	36.3	2,232

GRAND RIVER AT HOT SULPHUR SPRINGS, COLO.

This station was established July 27, 1904, by M. C. Hinderlider. It is located at the highway bridge about one-eighth mile below Hot Sulphur Springs, Colo., and 5 miles above the mouth of Williams Fork. A plain staff gage, graduated to feet and tenths, is bolted vertically to the downstream edge of the first pier from the right bank. The gage reads from 2 to 10.8 feet, the 2-foot mark resting on bed rock. It is read twice each day by E. E. Von Gohern. Discharge measurements, except at very low stages, are made from the upstream side of the three-span bridge to which the gage is attached. The initial point for soundings is located over the inner face of the right abutment, and is marked "0" on the upstream hub rail. Sounding points are marked on this rail every 2 feet to 124 feet. The channel above the station is curved at almost right angles. The current is swift, the water passing under the bridge squarely. The channel below the station is straight for about 200 feet, and the current is swift at high, and medium at low stages. Both banks are high, and can not overflow. The bed of the stream consists of bed rock, heavy gravel, and large bowlders on the right side. On the left, the channel is composed of a sloping gravel bar, extending outward to the left abutment. The channel is free from vegetation and permanent. There is but one channel, at all stages, broken by two piers. The accuracy of measurements will probably be affected by the boiling condition of the water alongside the right pier, and by the large bowlders in the channel beneath the bridge. Bench mark No. 1 is a United States Geological Survey standard bench-mark tablet set in cement in the south face of the sandstone cliff, near the north end of the bridge and about 2 feet above the roadway. Its elevation, painted on the tablet, is 18.99 feet above the zero of the gage. Bench mark No. 2 is a cross painted on the north pier above the gage rod. Its elevation is 16.48 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Grand River at Hot Sulphur Springs, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 26	W. A. Lamb	104	300	3.78	4.36	1,134
August 14	do	85	282	2.28	3.65	643
August 31	do	87	273	2.23	3.60	608
October 6	do	64	187	1.62	3.00	303

Mean daily gage height, in feet, of Grand River at Hot Sulphur Springs, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.05	4.05	3.10	2.80	2.72
2	.....	3.90	4.22	3.08	2.70	2.78
3	.....	3.85	3.98	3.12	2.70	2.80
4	.....	3.80	3.82	3.10	2.70	2.60
5	.....	3.80	3.62	3.02	2.60	2.40
6	.....	3.65	3.52	3.05	2.60	2.22
7	.....	3.60	3.52	3.02	2.60	2.35
8	.....	3.60	3.50	3.05	2.60	2.38
9	.....	3.50	3.45	3.02	2.60	2.45
10	.....	3.50	3.40	3.10	2.60	2.45
11	.....	3.40	3.30	3.08	2.60	2.38
12	.....	3.50	3.25	3.08	2.60	2.38
13	.....	3.65	3.25	3.10	2.60	2.35
14	.....	3.65	3.25	3.05	2.60	2.35
15	.....	3.70	3.00	3.05	2.60	2.35
16	.....	3.70	3.15	3.10	2.60	2.25
17	.....	3.75	3.15	3.10	2.70	2.35
18	.....	3.75	3.25	3.10	2.70	2.35
19	.....	4.10	3.22	2.98	2.70	2.35
20	.....	3.90	3.22	3.00	2.40	2.35
21	.....	3.95	3.20	2.95	2.40	2.38
22	.....	3.95	3.20	2.95	2.40	2.40
23	.....	3.80	3.20	2.95	2.78	2.38
24	.....	3.60	3.22	3.00	2.75	2.40
25	.....	3.60	3.08	3.00	2.70	.....
26	.....	3.65	3.02	2.90	2.75	.....
27	.....	3.65	3.10	3.00	2.75	.....
28	4.20	3.78	3.15	2.90	2.75	.....
29	4.15	3.70	3.10	2.80	2.70	.....
30	4.15	3.70	3.12	2.80	2.70	.....
31	4.10	3.60	.....	2.80	.....	.....

Rating table for Grand River at Hot Sulphur Springs, Colo., from July 27 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.80	245	3.05	333	3.40	501	3.90	790
2.85	260	3.10	355	3.50	554	4.00	860
2.90	276	3.15	378	3.60	609	4.10	930
2.95	294	3.20	402	3.70	666	4.20	1,010
3.00	313	3.30	450	3.80	725	4.30	1,090

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904, and is well defined.

Estimated monthly discharge of Grand River at Hot Sulphur Springs, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
July 28-31	1,010	930	970	7,696
August	995	501	685	42,120
September	1,026	313	491	29,220
October	364	245	320	19,680
November	245	125	198	11,780
December 1-24	245	71	132	6,283

GRAND RIVER NEAR KREMMLING, COLO.

This station was established July 24, 1904, by M. C. Hinderlider. It is located at the mouth or upper end of the Gore Canyon, about 3 miles south of Kremmling, Colo. A standard wire gage is attached to the cantilever arm of the frame to which the gage rod is spiked in a horizontal position. The gage rod is a 2 by 4 inch timber, 13 feet long, painted white, and graduated to feet and tenths, from 2 feet to 13 feet. The length of the wire from the end of the weight to the marker is 27.64 feet. The gage is read twice each day by J. C. Harper. Discharge measurements are made from a three-fourths inch wire cable stretched across the river just below the gage and about 150 feet above the wagon bridge. The cable is approximately 280 feet long and is tagged with tin tags, which are marked, every 5 feet from the top of the right bank, which is a high sandstone cliff, to the top of the left bank. The initial point for soundings is the face of the rock to which the cable is anchored on the right bank. The channel is straight for about 100 feet above and for 150 feet below the station. The current is very sluggish at low water and medium to swift at high water, but it is the only location available below the mouth of Blue River. The right bank is the old grade of the Denver and Northwestern Railroad, and is not subject to overflow. The left bank is abrupt, covered with bushes and large bowlders, and does not overflow. The bed of the stream is composed of sand and silt and scattering bowlders, clean of vegetation and reasonably permanent. The bench mark is a cross cut in the east face of a large bowlder on the right bank about 20 feet south of the cable, marked with black paint "U. S. B. M." Its elevation is 24.93 feet above the datum of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Grand River near Kremmling, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 24	W. A. Lamb	122	1,269	1.44	5.87	1,832
August 11	do	108	922	1.05	3.50	970
August 26	do	113	987	1.22	4.04	1,202
August 29	do	113	1,061	1.35	4.70	1,428
October 9	do	105	387	1.74	2.40	674

Mean daily gage height, in feet, of Grand River near Kremmling, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1		4.78	4.35	2.85	1.70	17		4.30	3.10	2.15	1.45
2		4.58	5.80	2.68	1.62	18		5.15	2.88	2.22	1.37
3		4.45	5.15	2.52	1.60	19		5.75	2.85	2.05	1.38
4		4.28	4.40	2.45	1.80	20		5.08	2.68	2.10	1.30
5		4.30	4.08	2.30	1.60	21		4.62	2.62	2.18	1.05
6		4.25	3.72	[a] 2.30	1.40	22		5.12	2.65	2.25	1.00
7		3.85	3.55	2.38	1.82	23		4.22	2.65	2.25	0.95
8		3.80	3.28	2.42	1.45	24	6.00	4.08	2.68	2.20	0.98
9		3.70	3.10	2.48	1.38	25	6.35	3.85	2.58	2.20	0.78
10		3.55	3.00	2.58	1.25	26	5.92	4.00	2.58	1.85	0.72
11		3.52	2.88	2.52	0.70	27	5.72	4.22	2.70	1.92	
12		3.70	2.75	2.42	0.80	28	5.32	4.68	2.65	1.92	
13		4.02	2.55	2.42	1.02	29	5.38	4.55	2.50	1.98	
14		4.32	2.42	2.38	1.20	30	5.45	4.30	2.55	1.82	
15		4.40	2.35	2.28	1.42	31	5.15	4.15		1.70	
16		4.28	2.55	2.20	1.32						

[a] Gage datum lowered 3 feet October 6. All gage heights refer to original datum.

Rating table for Grand River near Kremmling, Colo., from July 24 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	590	3.20	905	4.30	1,290	5.40	1,675
2.10	610	3.30	940	4.40	1,325	5.50	1,710
2.20	630	3.40	975	4.50	1,360	5.60	1,745
2.30	650	3.50	1,010	4.60	1,395	5.70	1,780
2.40	675	3.60	1,045	4.70	1,430	5.80	1,815
2.50	700	3.70	1,080	4.80	1,465	5.90	1,850
2.60	725	3.80	1,115	4.90	1,500	6.00	1,885
2.70	750	3.90	1,150	5.00	1,535	6.10	1,920
2.80	775	4.00	1,185	5.10	1,570	6.20	1,955
2.90	805	4.10	1,220	5.20	1,605	6.30	1,990
3.00	835	4.20	1,255	5.30	1,640	6.40	2,025
3.10	870						

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904 and is fairly well defined. Above gage height 3.00 feet the rating curve is a tangent, the difference being 35 per tenth.

Estimated monthly discharge of Grand River near Kremmling, Colo., for 1904.

[Drainage area, 2,380 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
July 24–31	2,008	1,588	1,765	28,220	0.742	0.222
August	1,798	1,010	1,308	80,430	.550	.634
September	1,815	662	893	53,140	.375	.420
October	790	530	646	39,720	.271	.312
November 1–26	554	397	470	24,240	.197	.191

GRAND RIVER AT GLENWOOD SPRINGS, COLO.

This station was first located May 12, 1899, at the request of the Denver and Rio Grande Railway Company, at the railroad bridge, a quarter of a mile west of the depot and just above the mouth of Roaring Fork. A wire gage was used. At the beginning of 1900, however, a new gage rod was located near the electric-light works. This gage consisted of a light vertical staff, to the lower end of which was attached a wooden float which rested on the surface of the water, standing in a well or box made of 6-inch boards. The bottom of this well connected with a small wooden flume extending out into the river, which allowed the water in the well to assume the level of the river surface. The vertical staff attached to the float was graduated to feet and tenths. In July, 1902, this gage, being in bad repair, was replaced with an automatic water register, the site being the same as that of the old float gage. This register never worked satisfactorily, and was later replaced with a float gage, using the same well and intake flume as was previously used. The present gage consists of a metal float and counterweight connected with a pliable wire passing over pulleys, so arranged that a rise of 1 foot in the river registers but one-half the amount on the rod. By this arrangement the large rise and fall of the river is readily accommodated by the length of gage, which would be impossible with a direct-reading gage. The gage rod proper consists of a light pine rod 1 by 1 inch by 5 feet long, securely fastened to the small house in which the apparatus is located. A pointer attached to a counterweight slides along the gage rod and registers the rise and fall of the river. This gage has given entire satisfaction. The gage and equipment are inclosed within a small house, which is kept locked. The observer, who is the engineer of the electric-light works, is located immediately across the street from the gage. Readings are taken in the morning and evening during the entire year. Measurements are made from the single-span steel wagon bridge crossing the river between the town and the hotel. The channel is good, being com-

posed of gravel and rock, and does not change much; the banks are high and not subject to overflow. The current is moderate to swift.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Grand River at Glenwood Springs, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 4	R. I. Meeker	189	512	1.61	3.55	822
April 25	do	195	903	3.40	5.20	3,067
May 23	do	203	1,478	7.81	8.30	11,540
May 26	do	206	1,541	12.00	9.10	18,500
June 27	do	203	1,274	6.94	7.42	8,840
August 6	do	192	752	2.80	4.79	2,103
August 8	G. B. Monk	189	727	2.82	4.60	2,047
September 5	R. I. Meeker	189	809	3.11	5.05	2,518

Mean daily gage height, in feet, of Grand River at Glenwood Springs, Colo., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.05	3.02	3.68	3.55	5.80	8.45	7.38	5.12	5.00	4.20	3.98	3.42
2	3.08	3.05	3.68	3.55	5.72	8.13	7.28	5.02	5.40	4.30	3.90	3.40
3	3.12	3.12	3.52	3.52	5.72	8.00	7.05	4.98	5.42	4.28	3.88	3.42
4	3.18	3.10	3.55	3.58	5.68	7.70	6.85	4.88	5.20	4.22	3.88	3.48
5	3.20	3.12	3.60	3.65	5.58	7.33	6.72	4.82	5.05	4.22	3.88	3.28
6	3.12	3.20	3.60	3.65	5.42	7.03	6.65	4.80	4.85	4.20	3.85	3.12
7	3.48	3.10	3.65	3.62	5.42	7.10	6.48	4.70	4.75	4.15	3.78	3.02
8	3.50	3.12	3.78	3.68	5.88	7.57	6.50	4.60	4.65	4.20	3.78	2.90
9	3.05	3.08	3.80	3.62	5.75	7.67	6.48	4.60	4.60	4.20	3.80	2.95
10	3.05	2.95	3.78	3.55	5.65	7.80	6.40	4.58	4.52	4.20	3.78	3.12
11	3.10	3.05	3.80	3.60	5.78	8.23	6.38	4.52	4.48	4.25	3.50	3.20
12	3.12	3.12	3.82	3.92	6.08	8.25	6.35	4.52	4.42	4.25	3.32	3.25
13	3.12	3.18	3.72	4.52	6.40	8.55	6.25	4.58	4.32	4.22	3.38	3.35
14	3.12	3.18	3.72	5.00	6.68	8.67	6.18	4.68	4.20	4.22	3.45	3.38
15	3.15	3.22	3.78	5.28	6.82	8.65	6.08	4.78	4.20	4.20	3.55	3.35
16	3.12	3.22	3.70	5.48	6.80	8.52	5.92	4.82	4.20	4.12	3.65	3.30
17	3.15	3.25	3.65	5.52	6.70	8.52	5.85	4.82	4.20	4.08	3.70	3.28
18	3.22	3.25	3.60	5.55	6.70	8.50	5.80	4.90	4.35	4.10	3.70	3.35
19	3.20	3.18	3.70	5.70	7.05	8.38	5.70	5.30	4.32	4.08	3.78	3.32
20	3.15	3.18	4.00	5.85	7.60	8.45	5.60	5.42	4.32	4.02	3.70	3.30
21	3.08	3.20	4.05	5.90	7.98	8.50	5.48	5.15	4.25	3.98	3.55	3.30
22	3.05	3.15	3.98	5.95	8.15	8.28	5.48	5.10	4.20	4.02	3.55	3.32
23	3.02	3.22	3.80	5.48	8.32	8.12	5.45	5.18	4.28	4.05	3.48	3.38
24	3.08	3.38	3.72	5.32	9.05	7.92	5.45	4.95	4.28	4.10	3.40	3.40
25	3.08	3.55	3.68	5.20	9.32	8.85	5.78	4.85	4.22	4.10	3.38	3.38
26	2.98	3.52	3.52	5.10	9.10	7.70	5.48	4.78	4.20	4.10	3.35	3.38
27	2.95	3.58	3.52	5.22	8.78	7.45	5.38	4.80	4.25	4.00	3.35	3.20
28	3.00	3.75	3.52	5.60	8.52	7.42	5.22	4.90	4.30	4.00	3.45	2.95
29	2.95	3.65	3.55	5.98	8.28	7.35	5.18	5.08	4.30	4.00	3.32	2.75
30	3.02	.....	3.58	6.05	8.30	7.40	5.18	5.08	4.25	4.00	3.38	2.82
31	3.08	.....	3.50	.....	8.70	.....	5.22	5.00	.....	3.95	.....	3.05

Rating table for Grand River at Glenwood Springs, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.80	380	3.80	990	4.70	2,000	6.20	4,640
2.90	430	3.90	1,080	4.80	2,140	6.40	5,090
3.00	480	4.00	1,180	4.90	2,290	6.60	5,580
3.10	530	4.10	1,290	5.00	2,440	6.80	6,110
3.20	580	4.20	1,400	5.20	2,740	7.00	6,670
3.30	630	4.30	1,510	5.40	3,050	7.50	8,260
3.40	690	4.40	1,630	5.60	3,400	8.00	10,210
3.50	760	4.50	1,750	5.80	3,790	8.50	12,610
3.60	830	4.60	1,870	6.00	4,210	9.00	15,640
3.70	910						

The above table is applicable only for open-channel conditions. It is based upon 27 discharge measurements made during 1900 to 1904, inclusive, and is well defined. It is the same as the 1903 rating table to 8.00 feet gage height.

Estimated monthly discharge of Grand River at Glenwood Springs, Colo., for 1904.

[Drainage area, 4,523 square miles.[a]]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	760	455	539	33,140	0.119	0.137
February	950	455	605	34,800	.134	.144
March	1,235	760	911	56,020	.201	.232
April	4,315	774	2,291	136,300	.507	.566
May	18,080	3,084	7,759	477,100	1.72	1.98
June	14,640	6,757	10,510	625,400	2.32	2.59
July	7,844	2,710	4,420	271,800	.977	1.13
August	3,084	1,774	2,271	139,600	.502	.579
September	3,084	1,400	1,781	106,000	.394	.440
October	1,510	1,130	1,323	81,350	.293	.338
November	1,160	642	854	50,820	.189	.211
December	746	355	599	36,830	.132	.152
The year	18,080	355	2,822	2,049,000	.624	8.50

[a] This area has been revised since the 1903 report.

GRAND RIVER NEAR PALISADES, COLO.

This station was established April 9, 1902, by John E. Field. It is located at the iron highway bridge at the point where the river enters Grand Valley, about 2 miles above Palisades. The station is above all irrigating ditches supplying water to Grand Valley, with the exception of one pumping plant, which takes about 20 second-feet from the river one-fourth mile above the station. The gage, as originally installed, was of wire with window weight and located on downstream side near center of bridge. On April 5, 1904, the old wire gage was replaced by a new chain gage. Zero on new chain gage is identical with zero of wire gage. The scale on the inside of the box reads from 11.6 to 22.7 feet. At low water, depth of water at gage is about 12 feet. The length of chain from end of weight to center of marker is 21.27 feet. The gage is read twice daily by E. N. Purdy, who is engineer at the Mount Lincoln pumping plant above the bridge. Discharge measurements are made from the lower side of the single-span bridge to which the gage is attached. The initial point for soundings is the edge of the cap stone of masonry abutment of bridge on the left bank. The channel is straight for 600 feet above and below the station. The right bank is high and rocky and will not overflow. The left bank is somewhat lower and will overflow at extreme high water. Above the banks the mountains rise rather abruptly on either side. The bed of the stream is composed of large bowlders, which are covered at low water with a deposit of mud. During high water this deposit is carried away, and at low water a new deposit forms. The bench mark is a point on cap stone of the approach abutment on the right bank of the river. A circle is cut about the point and also the letters "B. M." The elevation of bench mark is 29.49 feet above zero of gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Grand River near Palisades, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 6	R. I. Meeker	145	1,199	1.10	12.40	1,318
April 26	do	155	1,524	2.87	14.15	4,367
May 28	do	212	2,500	7.82	19.15	19,560
July 2	do	180	2,064	5.75	17.00	11,880
August 10	do	181	1,314	1.93	13.20	2,538
September 7	do	180	1,394	2.18	13.50	3,041

Mean daily gage height, in feet, of Grand River near Palisades, Colo., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	12.25	15.25	19.15	17.40	14.15	14.25	13.10
2	12.20	15.10	18.70	17.10	13.90	14.15	13.10
3	12.25	15.10	18.40	16.85	13.75	14.30	13.10
4	12.20	15.05	18.05	16.65	13.60	14.20	13.00
5	12.35	14.85	17.55	16.55	13.55	13.95	12.90
6	12.50	14.65	17.10	16.30	13.50	13.60	13.15
7	12.50	14.65	16.85	16.10	13.40	13.45	13.25
8	12.50	15.20	17.20	16.00	13.35	13.35	13.15
9	12.45	15.25	17.60	15.95	13.30	13.20	13.15
10	12.40	15.10	17.75	15.85	13.20	13.15	13.20
11	12.40	15.20	17.95	15.85	13.10	13.00	13.10
12	12.55	15.70	18.45	15.85	13.10	13.05	13.10
13	13.00	16.30	19.00	15.75	13.20	12.95	13.10
14	13.75	16.75	19.10	15.60	13.30	12.90	13.00
15	14.10	16.80	19.10	15.45	13.40	12.80	13.00
16	14.35	16.95	18.95	15.30	13.45	12.70	12.95
17	14.65	16.85	18.85	15.20	13.40	12.80	12.90
18	14.65	16.85	18.90	15.05	13.70	12.80	12.80
19	15.05	17.30	18.90	14.90	13.75	12.90	12.85
20	15.15	17.80	18.80	14.80	14.20	12.85	12.80
21	15.30	18.10	18.95	14.55	13.95	12.80	12.80
22	15.35	18.45	18.75	14.45	13.80	12.85	12.80
23	15.00	18.70	18.50	14.45	13.75	13.05	12.80
24	14.55	19.60	18.25	14.35	13.75	13.10	12.80
25	14.35	20.00	18.15	14.35	13.55	13.00	12.80
26	14.20	19.75	17.90	14.35	13.40	13.15	12.80
27	14.25	19.40	17.50	14.35	13.50	13.10	12.70
28	14.75	19.15	17.45	14.25	13.95	13.15	12.70
29	15.30	18.90	17.45	14.10	13.85	13.10	12.60
30	15.50	18.90	17.50	14.15	13.90	13.15	12.60
31	.....	19.15	.....	14.30	13.75	.....	12.60

Rating table for Grand River near Palisades, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
12.20	1,320	13.30	2,710	14.40	4,920	16.40	10,120
12.30	1,400	13.40	2,870	14.60	5,400	16.60	10,680
12.40	1,500	13.50	3,040	14.80	5,880	16.80	11,270
12.50	1,600	13.60	3,220	15.00	6,360	17.00	11,870
12.60	1,710	13.70	3,400	15.20	6,860	17.50	13,520
12.70	1,830	13.80	3,600	15.40	7,380	18.00	15,460
12.80	1,950	13.90	3,800	15.60	7,900	18.50	17,540
12.90	2,090	14.00	4,020	15.80	8,440	19.00	19,720
13.00	2,230	14.10	4,240	16.00	9,000	19.50	22,100
13.10	2,390	14.20	4,460	16.20	9,560	20.00	24,800
13.20	2,550	14.30	4,680				

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1902, 1903, and 1904. It is well defined between gage heights 13.00 and 17.00 feet. Measurements between gage heights 12.00 and 13.00 feet are scattered and uncertain. The table has been extended above 17.00 feet gage height.

Estimated monthly discharge of Grand River near Palisades, Colo., for 1904.

[Drainage area, 8,546 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April	7,640	1,320	3,906	232,400	0.457	0.510
May	24,800	5,520	12,800	787,000	1.50	1.73
June	20,400	11,420	16,480	980,600	1.93	2.15
July	13,170	4,240	7,400	455,000	.866	.998
August	4,460	2,390	3,242	199,300	.379	.437
September	4,680	1,830	2,654	157,900	.311	.347
October	2,630	1,710	2,141	131,600	.251	.289
The period				2,944,000		

FRASER RIVER NEAR COULTER, COLO.

This station was established July 28, 1904, by M. C. Hinderlider. It is located at the wagon bridge on the main road between Coulter and Grand Lake, Colo., and about 3 miles above the mouth of Fraser River. A plain staff gage, graduated to feet and tenths, is spiked vertically to the downstream inner edge of the first pier from the left bank. The gage reads from 2 to 10.8 feet, the 2-foot mark resting on the bed of the stream. It is read twice each day by J. N. Ostrander. Discharge measurements are made from the downstream side of the three-span bridge to which the gage is attached, and which is numbered on the hand rail every 2 feet from zero to 81 feet. The initial point for soundings is immediately over the inner face of the left abutment and marked "zero" on the downstream hand rail. The channel is straight for about 100 feet above, and curved for about 100 feet below the station. The current is medium above and swift below the measuring section. The right bank is about 2 feet high, covered with willows, and overflows at very high stages. The left bank above the station is a high abrupt mesa. Below the station is a 6-foot mesa for about 50 feet, then a low, brush-covered flat which is overflowed at high stages. The bed of the stream is composed of smooth cobblestones, and the cross section is fairly uniform, clean, and permanent. There is one channel at all stages, broken by two crib piers. A small and temporary dam a portion of the way across the stream, 30 feet below the bridge, may affect the gage readings at times if changed. Bench mark No. 1 is a nail in the top of a white pine stake driven into the left bank about 30 feet southeast of the left end of the bridge, projecting

about 6 inches above the surface of the ground, and marked "U. S. G. S. B. M." Its elevation is 13.12 feet above the zero of the gage. Bench mark No. 2 was established October 6, 1904. It is a cross cut on the top of the foundation stone at the southeast corner of the residence of the observer. The stone is marked "U. S. B. M." on the east face. The elevation of the bench mark is 13.09 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Fraser River near Coulter, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 28	W. A. Lamb	73	129	2.22	5.04	286
August 14	do	72	107	1.61	4.88	172
August 31	do	70	108	1.53	4.85	165
October 6	do	69	90	1.11	4.63	100

Mean daily gage height, in feet, of Fraser River near Coulter, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	.....	4.95	5.25	4.65	17	.....	4.82	4.82	4.58
2	.....	4.90	5.20	4.60	18	.....	5.20	4.75	4.55
3	.....	4.90	5.00	4.60	19	.....	4.98	4.70	[a]4.50
4	.....	4.90	4.92	4.65	20	.....	4.90	4.70	4.50
5	.....	4.85	4.88	4.65	21	.....	4.92	4.75	4.60
6	.....	4.85	4.85	4.65	22	.....	4.92	4.70	4.60
7	.....	4.80	4.80	4.60	23	.....	4.88	4.70	4.60
8	.....	4.82	4.80	4.60	24	.....	4.80	4.70	4.62
9	.....	4.85	4.75	4.60	25	.....	4.75	4.70	4.55
10	.....	4.80	4.75	4.60	26	.....	4.85	4.70	4.50
11	.....	4.75	4.75	4.60	27	.....	4.85	4.65	4.45
12	.....	4.80	4.70	4.65	28	5.00	4.92	4.60	4.35
13	.....	4.95	4.70	4.65	29	5.02	4.80	4.70	4.35
14	.....	4.88	4.70	4.60	30	5.05	4.82	4.65	4.35
15	.....	4.88	4.65	4.60	31	4.95	4.82	.....	4.35
16	.....	4.85	4.90	4.60					

[a] Ice conditions, October 19 to end of year.

Rating table for Fraser River near Coulter, Colo., from July 28 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.35	52	4.60	91	4.85	165	5.10	340
4.40	59	4.65	102	4.90	188	5.15	400
4.45	66	4.70	114	4.95	215	5.20	470
4.50	73	4.75	128	5.00	248	5.25	550
4.55	81	4.80	145	5.05	290		

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904. It is well defined between gage heights 4.65 feet and 5.05 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Fraser River near Coulter, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
July 28–31	290	215	254	2,015
August	470	128	181	11,130
September	550	91	158	9,402
October [a]	102	52	84.9	5,220

[a] October 19–31 rating table applied as for open channel.

WILLIAMS FORK NEAR HOT SULPHUR SPRINGS, COLO.

This station was established July 25, 1904, by M. C. Hinderlider. It is located at a wagon bridge on the ranch of F. A. Field, about 9 miles west of Hot Sulphur Springs, Colo., and about the same distance above the mouth of the river. A plain staff gage, graduated to feet and tenths from 2 feet, which is on the bed of the stream, to 8 feet, is fastened vertically to the downstream end of the middle crib pier. It is read twice each day by F. A. Field. Discharge measurements are made from the downstream side of the two-span bridge to which the gage is attached. The initial point for soundings is a 60-penny nail driven into the top of the left end of the downstream guard rail of the bridge, immediately over the inside face of the abutment. Sounding points are marked every 2 feet by nails on the downstream guard rail. The channel is straight for about 100 feet above and below the station. The current is very swift and somewhat rough above, and swift and fairly smooth below the section. The right bank is a low gravel bar, lined with willows, and overflows at very high stages. The left bank is level pasture lands, about 4 feet high, and is not liable to overflow. The bed of the stream is composed of small and medium sized bowlders, and is permanent. The middle pier may

slightly affect the measurements at high stages. The bench mark is a 60-penny nail driven into the south face of a small white pine tree standing on the left bank of the river, 30 feet north of the west end of the bridge. Its elevation is 6.03 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Williams Fork near Hot Sulphur Springs, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 25	W. A. Lamb	54	78	3.41	3.95	266
August 13	do	50	70	2.13	3.69	149
August 30	do	50	66	2.09	3.66	138
October 7	do	48	58	1.69	3.45	98

Mean daily gage height, in feet, of Williams Fork near Hot Sulphur Springs, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1	.....	3.77	3.70	3.45	17	.....	3.56	3.52	3.35
2	.....	3.74	3.66	3.41	18	.....	3.65	3.50	3.30
3	.....	3.71	3.62	3.40	19	.....	3.62	3.51	3.28
4	.....	3.70	3.56	3.39	20	.....	3.56	3.48	3.36
5	.....	3.69	3.55	3.39	21	.....	3.60	3.50	3.36
6	.....	3.67	3.54	3.38	22	.....	3.56	3.50	3.38
7	.....	3.64	3.54	3.40	23	.....	3.56	3.50	3.32
8	.....	3.69	3.54	3.40	24	.....	3.54	3.50	3.32
9	.....	3.66	3.52	3.41	25	3.95	3.54	3.48	3.24
10	.....	3.54	2.50	3.40	26	3.90	3.59	3.48	3.26
11	.....	3.55	3.50	3.39	27	3.88	3.56	3.47	3.25
12	.....	3.58	3.49	3.40	28	3.86	3.60	3.43	3.28
13	.....	3.57	3.48	3.40	29	3.87	3.55	3.42	3.38
14	.....	3.56	3.48	3.36	30	3.85	3.56	3.44	3.32
15	.....	3.56	3.46	3.40	31	3.80	3.54	.....	3.25
16	.....	3.56	3.44	3.38					

Rating table for Williams Fork near Hot Sulphur Springs, Colo., from July 25 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.25	70	3.45	98	3.65	137	3.85	206
3.30	76	3.50	107	3.70	150	3.90	234
3.35	83	3.55	116	3.75	165	3.95	266
3.40	90	3.60	126	3.80	183		

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904. It is well defined between gage heights 3.45 feet and 3.95 feet. The table has been extended below gage height 3.45 feet.

Estimated monthly discharge of Williams Fork near Hot Sulphur Springs, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
July 25–31	266	183	220	3,055
August	172	114	129	7,932
September	150	93	109	6,486
October	98	69	84	5,165

TROUBLESOME RIVER AT TROUBLESOME, COLO.

This station was established July 22, 1904, by M. C. Hinderlider. It is located about 100 yards below the highway bridge at Troublesome, Colo. The gage is an inclined plain staff, graduated to feet and tenths, vertically from 0.8 to 5.8 feet, securely fastened to stakes driven into the left bank and bed of the stream. One vertical foot equals 1.525 feet on the slope. The gage is read twice each day by Mrs. Eva Becker. Discharge measurements are made at almost all stages of flow by wading at or near the gage. At exceedingly high stages they may be made from the two-span bridge about 100 yards above the gage rod. The initial point for soundings is the west face of the stake driven into the top of the left bank, and to which the gage rod is fastened. The channel is straight for about 50 feet above and for 150 feet below the station. The current is of moderate velocity and uniform. The right bank is about 3 feet high, lined with a heavy growth of willows, and is not subject to overflow. The left bank is precipitous, about 4 feet high, and is a level meadow which does not overflow. The bed of the stream is composed of small cobblestones and gravel, and is clean, uniform, and stable. There is but one channel at all stages, the depths varying from 1 to 4 feet. There are no adverse conditions except at extremely high stages, when measurements must be made from the highway bridge, which is a poor place owing to poor cross section, bridge abutments, and temporary dam a few feet above. Bench mark No. 1 is a 10-penny nail driven into the top of the stake on the left bank, to which the gage rod is fastened. Its elevation is 5.83 feet above the zero of the gage. Bench mark No. 2 is the center of a cross painted with black paint on the bottom log near the southeast corner of the observer's house, and marked "U. S. B. M." Its elevation is 16.08 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Troublesome River at Troublesome, Colo., in 1904.

Date.	Hydrographer.	Width	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 22	Hinderlider and Lamb	27	23	0.91	2.01	21
August 13	W. A. Lamb	24	21	.76	1.93	16
August 30	do	28	24	1.12	2.07	27
October 7	do	26	25	1.08	2.02	27

Mean daily gage height, in feet, of Troublesome River at Troublesome, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1		a 1.95	2.20	2.00	17		2.00	1.95	2.00
2		a 1.95	2.20	2.00	18		2.10	1.95	2.00
3		a 1.90	2.10	2.00	19		2.10	2.00	1.98
4		a 1.90	2.05	2.02	20		2.50	2.00	1.95
5		a 1.90	2.00	2.00	21		2.10	2.00	2.00
6		a 1.90	2.00	2.00	22		2.10	2.00	2.00
7		1.90	2.00	2.00	23	2.00	2.00	2.00	2.00
8		1.90	2.00	2.00	24	1.95	2.00	2.00	2.00
9		1.90	2.00	2.00	25	2.05	2.05	2.00	2.00
10		1.90	2.00	2.10	26	1.98	2.10	2.00	1.95
11		1.90	2.00	2.05	27	1.92	2.10	2.00	1.95
12		2.00	a 2.00	2.00	28	1.95	2.25	2.00	1.95
13		1.90	2.00	2.00	29	2.10	2.15	2.00	1.95
14		1.90	2.00	2.00	30	2.00	2.10	2.00	1.90
15		2.00	1.95	2.00	31	a 2.00	2.00		1.95
16		2.00	1.95	2.00					

a Estimated.

Rating table for Troublesome River at Troublesome, Colo., from July 22 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.90	14	2.10	30	2.25	48	2.40	74
1.95	17	2.15	35	2.30	55	2.45	86
2.00	21	2.20	41	2.35	64	2.50	100
2.05	25						

The above table is applicable only for open-channel conditions. It is based upon 3 discharge measurements made during 1904, between gage heights 1.93 feet and 2.07 feet, and on an extension from 2.07 to 2.50 based on logarithmic curve.

Estimated monthly discharge of Troublesome River at Troublesome, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
July 23–31	30	15	20.7	375
August	100	14	24.3	1,494
September	41	17	22.2	1,321
October	30	14	20.4	1,255

MUDDY RIVER NEAR KREMMLING, COLO.

This station was established July 24, 1904, by M. C. Hinderlider. It is located at the wagon bridge about one-eighth mile southwest of Kremmling, Colo., and about 2 miles above the junction of Muddy River with Grand River. A plain staff gage, graduated to feet and tenths, is attached vertically to the lower left corner of the middle crib pier of the bridge. The gage reads from 2 to 14 feet, the 2-foot mark resting on the bed of the stream. It is read twice each day by E. A. Magee. Discharge measurements are made during high water from the downstream side of the two-span highway bridge to which the gage is attached, and at ordinary and low stages by wading near the gage. The initial point for soundings is a 10-penny nail driven in the downstream hand rail over the north face of the left abutment. The hand rail is marked from 0 to 58 feet with nails driven in flush. The channel is curved for about 100 feet above and straight for 50 feet below the station. The current is sluggish. The right bank is clean and almost perpendicular. It is about 10 feet high below, and 8 feet high above the station. The left bank below the bridge slopes at an angle of about 45 , is 10 feet high, and lined with willows. Above the bridge it is irregular, about 8 feet high, and is overflowed at very high water out for 50 to 100 feet. Both banks are meadow or pasture lands. The bed of the stream is composed of mud, with some sand and a few loose rock washed from the riprap about the south abutment. It is clean, but shifting. There is one channel broken by the middle pier. The tortuous nature of the channel, unstable bed, and middle pier of the bridge are conditions which may affect the measurements. The bench mark is a 60-penny spike driven horizontally into the west face of the left end of the downstream bridge stringer, over the left abutment. Its elevation is 13.65 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Muddy River near Kremmling, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
August 13	W. A. Lamb	9	5	1.20	4.30	6
August 30	do	35	21	1.29	4.75	27
October 7	do	16	15	.80	4.33	12

Mean daily gage height, in feet, of Muddy River near Kremmling, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1		4.25	4.88	4.45	17		4.30	4.30	4.45
2		4.28	4.92	4.45	18		4.50	4.45	4.42
3		4.25	4.90	4.50	19		4.50	4.52	4.48
4		4.20	4.82	4.42	20		4.50	4.50	4.55
5		4.22	4.70	4.40	21		4.65	4.42	4.52
6		4.22	4.70	4.35	22		4.50	4.38	4.42
7		4.20	4.55	4.40	23		4.50	4.40	4.40
8		4.20	4.35	4.50	24		4.50	4.48	4.42
9		4.22	4.30	4.50	25	4.30	4.42	4.45	4.40
10		4.22	4.25	4.55	26	4.25	4.40	4.40	4.42
11		4.20	4.25	4.58	27	4.25	4.40	4.55	4.42
12		4.25	4.22	4.60	28	4.22	4.80	4.58	4.40
13		4.28	4.20	4.55	29	4.30	4.70	4.52	4.40
14		4.20	4.28	4.48	30	4.25	4.75	4.48	4.35
15		4.20	4.20	4.42	31	4.28	4.80		4.30
16		4.20	4.20	4.40					

BLUE RIVER NEAR KREMMLING, COLO.

This station was established July 21, 1904, by M. C. Hinderlider. It is located at the State highway bridge on the road between Kremmling and Dillon, Colo., distant from the two towns 22 and 20 miles, respectively. The station is below the mouth of all tributaries of any importance. A plain staff gage, graduated to feet and tenths, is attached vertically to the west face of the middle masonry pier near the downstream end. The gage reads from 2 to 11 feet, the 2-foot mark resting on the bed of the stream. It is read daily by Miss Kathryn Sexton. Discharge measurements are made from the downstream side of the two-span iron bridge to which the gage is attached. The initial point for soundings is a 40-penny nail driven into the downstream guard rail at the left end of the bridge immediately over the east face of the left abutment. It is marked zero, and the bridge floor is marked and numbered each 5 feet from zero to 167.7 feet. The channel is straight for about 400 feet above and 200 feet below the station, and the current is very swift and rough. Both banks are

lined with willows and are not subject to overflow. The bed of the stream is rough, there being several bowlders of considerable size which break the current. Otherwise it is clean and stable. There is one channel at all stages broken by the middle pier of the bridge. Owing to the roughness of the bed, the station is not a good one, but it is the only available point where an observer can be obtained. Bench mark No. 1 is a cross cut in the top of the second step from the top of the downstream wing of the left abutment. It is painted black and marked "U. S. B. M." Its elevation is 9.036 feet above the zero of the gage. Bench mark No. 2 is a 60-penny spike driven vertically into the west end of block to which the pulley is fastened. Its elevation is 11.68 feet above the zero of the gage.

On August 28, 1904, a regulation chain gage was established by W. A. Lamb to replace the wooden gage, the elevation of the datum of the two gages being the same.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Blue River near Kremmling, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 21	W. A. Lamb	160	271	3.70	3.10	1,003
August 12	do	158	220	2.93	2.80	644
August 28	do	160	243	3.63	3.03	881
October 8	do	154	134	2.49	2.40	334

Mean daily gage height, in feet, of Blue River near Kremmling, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1		2.90	2.80	2.55	17		2.95	2.50	2.40
2		2.90	2.90	2.45	18		3.20	2.55	2.40
3		2.85	2.90	2.40	19		3.20	2.50	2.35
4		2.85	2.70	2.40	20		3.00	2.30	2.40
5		2.85	2.55	2.40	21		2.90	2.35	2.40
6		2.85	2.50	2.40	22	3.20	3.00	2.40	2.40
7		2.80	2.48	2.45	23	3.10	2.90	2.40	2.35
8		2.80	2.45	2.40	24	3.10	2.85	2.50	2.30
9		2.80	2.40	2.50	25	3.20	2.80	2.45	2.30
10		2.75	2.45	2.50	26	3.20	2.80	2.58	2.30
11		2.75	2.35	2.40	27	3.05	2.95	2.60	2.30
12		2.85	2.45	2.40	28	3.00	2.95	2.55	2.30
13		2.90	2.40	2.40	29	3.05	2.60	2.50	2.30
14		3.00	2.40	2.40	30	3.05	2.75	2.50	2.25
15		3.05	2.30	2.40	31	2.98	2.80		2.25
16		2.90	2.50	2.40					

Rating table for Blue River near Kremmling, Colo., from July 22 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.20	240	2.45	365	2.70	545	2.95	785
2.25	260	2.50	400	2.75	585	3.00	850
2.30	280	2.55	435	2.80	625	3.10	1,000
2.35	305	2.60	470	2.85	670	3.20	1,185
2.40	335	2.65	505	2.90	725		

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904 and is fairly well defined.

Estimated monthly discharge of Blue River near Kremmling, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
July 22–31	1,185	824	999	19,820
August	1,185	470	727	44,700
September	725	280	411	24,460
October	435	260	327	20,110

TENMILE CREEK NEAR KOKOMO, COLO.

This station was established April 2, 1904, by R. I. Meeker, and is located at the wagon bridge at Admiral mine, 8 miles below Kokomo, Colo. This station replaces the station established by F. Cogswell at Uneva Lake, 2 miles below, on September 25, 1903. The station was changed on account of poor conditions at Uneva Lake. The drainage basin embraces an entirely mountainous area of 69 square miles. These mountains are very steep and rocky. The slopes in a considerable portion of this area have no soil formation whatever. This barren area is partly above timber line, but in many places below. The greater portion of run-off, perhaps 90 per cent, is from melting snows which fall from September to May.

The gage is a vertical 1 by 4 inch board nailed to the downstream side of the first pier from the left end of the bridge, and is graduated from zero to 4 feet in feet, tenths, and fiftieths; from 4 to 5.5 feet in feet and tenths. It is read twice each day by Don McFadgen. Discharge measurements are made at high water from the downstream side of the bridge, to which the gage is attached. The initial point for soundings is the left end of the bridge on the downstream side at the abut-

ment. Discharge measurements are made at low water by wading. The channel is straight for about 150 feet above and for 800 feet below the station. The current is sluggish at low water. Both banks are low, but are not subject to overflow. The right bank is covered with brush. The left bank is rocky, with scattered brush along the edge. There is one channel at high and several channels at low water. The bed of stream is of shifting sand.

The regulation of the flow of water into the Admiral mine power line at dam 600 feet below the station will interfere slightly with the gage heights. The bench mark is a circular hole cut in the top of a large boulder 80 feet downstream from the gage rod and just to the left of the Denver and Rio Grande Railway tracks. Its elevation is 9.66 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Tenmile Creek near Kokomo, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 2 [a]	R. I. Meeker	8	10	1.00	0.97	10
April 23	do	46	53	1.53	1.55	81
May 31	do	73	220	2.37	3.57	522
June 29	do	67	142	1.76	2.44	250
August 5	do	38	54	1.44	1.18	78
September 3	do	36	47	1.34	1.00	63
November 5 [b]	do		7	2.29	.54	16

[a] By wading.
[b] Measurement made in flume, and includes 3.5 second-feet flowing in old channel.

Mean daily gage height, in feet, of Tenmile Creek near Kokomo, Colo., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	0.98	1.83	3.49	2.48	1.19	1.25	0.80	0.60
2	.....	1.00	1.68	a 3.10	2.34	1.25	1.11	.78	.64
3	.....	.96	1.70	2.80	2.28	1.22	1.04	.78	.62
4	.....	.92	1.46	2.36	2.15	1.24	.94	.77	.60
5	.....	.90	1.26	2.33	2.14	1.16	.89	a .80	.55
6	0.75	.85	1.30	2.53	2.08	1.18	.91	a .89	.55
7	.95	.85	1.48	2.94	2.15	1.16	.88	.80	.50
8	.85	.94	1.36	3.26	2.08	1.15	.81	.80	.50
9	.90	.93	1.33	3.00	2.10	1.12	.80	.78	.45
10	.95	.87	1.40	3.28	2.00	1.10	.80	.76	.45
11	.78	.58	1.74	3.95	2.00	1.16	.79	.73	.45
12	.78	.62	2.04	4.08	1.99	1.18	.74	.73	.45
13	.75	.70	2.35	4.20	1.96	1.18	.74	.74	.45
14	.88	.70	2.04	3.68	1.80	1.26	.72	.74	.45
15	.75	.76	2.28	3.70	1.80	1.29	.74	.72	.45
16	.78	.90	2.11	3.68	1.95	1.30	1.04	.68	.45
17	1.02	1.40	2.50	3.51	1.84	1.31	.90	.68	.45
18	1.02	1.95	3.05	3.35	1.65	1.74	.85	.68	.45
19	.78	1.80	3.88	3.65	1.60	1.39	.80	.72	.45
20	.75	2.04	4.11	3.36	1.59	1.16	.80	.70	.45
21	.82	1.89	3.91	3.23	1.58	1.28	.82	.70	.....
22	.91	1.70	4.39	3.17	1.49	1.24	.79	.70	.....
23	a .88	1.54	5.12	3.07	1.46	1.12	.80	.70	.....
24	.85	1.35	5.16	2.88	1.54	1.11	.78	.68	.....
25	.82	1.28	4.18	2.64	1.55	1.11	.76	.70	.....
26	.90	1.22	3.70	2.61	1.40	1.11	.76	.65	.....
27	.88	1.63	3.72	2.64	1.34	1.30	.74	.64	.....
28	.75	1.87	3.40	2.78	1.31	1.40	.71	a .65	.....
29	.76	1.76	4.45	2.84	1.41	a 1.20	.72	a .70	.....
30	.78	1.84	4.09	2.80	1.34	a 1.10	.96	.74	.....
31	1.05	.....	3.80	.....	1.19	1.00	.....	.55	.....

a Estimated

Rating table for Tenmile Creek near Kokomo, Colo., from March 6 to May 17, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.60	1	1.05	16	1.50	73	1.90	140
.65	1	1.10	21	1.55	81	1.95	150
.70	2	1.15	27	1.60	89	2.00	160
.75	2	1.20	33	1.65	97	2.10	180
.80	3	1.25	39	1.70	105	2.20	200
.85	4	1.30	45	1.75	113	2.30	220
.90	6	1.35	52	1.80	122	2.40	240
.95	9	1.40	59	1.85	131	2.50	260
1.00	12	1.45	66				

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904. It is not well defined.

Rating table for Tenmile Creek near Kokomo, Colo., from May 18 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.45	10	1.45	106	2.45	250	3.45	489
.50	14	1.50	111	2.50	260	3.50	503
.55	18	1.55	116	2.55	270	3.60	531
.60	22	1.60	121	2.60	280	3.70	560
.65	26	1.65	126	2.65	290	3.80	590
.70	31	1.70	131	2.70	301	3.90	620
.75	36	1.75	136	2.75	312	4.00	650
.80	41	1.80	142	2.80	323	4.10	680
.85	46	1.85	149	2.85	335	4.20	710
.90	51	1.90	156	2.90	347	4.30	745
.95	56	1.95	164	2.95	359	4.40	780
1.00	61	2.00	172	3.00	371	4.50	815
1.05	66	2.05	180	3.05	384	4.60	850
1.10	71	2.10	188	3.10	397	4.70	885
1.15	76	2.15	196	3.15	410	4.80	920
1.20	81	2.20	204	3.20	423	4.90	955
1.25	86	2.25	213	3.25	436	5.00	995
1.30	91	2.30	222	3.30	449	5.10	1,035
1.35	96	2.35	231	3.35	462	5.20	1,075
1.40	101	2.40	240	3.40	475		

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904, and is fairly defined. It has been extended above gage height 3.60 feet.

Estimated monthly discharge of Tenmile Creek near Kokomo, Colo., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March 6–31	16	2	5.3	273
April	168	1	50.4	3,000
May	1,059	40	374	23,000
June	710	227	421	25,050
July	256	80	149	9,161
August	135	61	82.6	5,079
September	86	32	45.6	2,714
October	41	18	33.3	2,047
November 1–20	25	10	13.8	547
The period				70,870

GUNNISON RIVER NEAR CIMARRON, COLO.

This station was established September 18, 1903, by W. N. Sammis. It is located just above the Denver and Rio Grande Railroad bridge, about 1 mile from Cimarron, Colo., and about 1,000 feet above the mouth of Cimarron River. The chain gage is located on the upstream side of the railroad bridge near the center of the stream and about 100 feet below the gaging section. The gage reads from zero to 20 feet with two markers, the second marker being used above 10 feet gage heights. The length of chain from end of weight to center of first marker is 56.06 feet. The second marker is 46.06 feet from end of weight. The gage is read twice each day by G. C. Gates. Discharge measurements are made by means of a cable and car. A stay line is stretched across the river about 50 feet above the cable for the careful manipulation of the meter, as the velocity at the section is usually above 4 feet in the center of the stream. The bench mark is the top of southeast corner capstone of east masonry abutment of the Denver and Rio Grande Railroad bridge. A line is cut across the corner of the capstone to indicate the bench mark. The elevation of the bench mark is 56.52 feet above the zero of the gage. The right end of the cable is directly under the end of the bridge on the right bank. The initial point for soundings is the face of the rock cliff at left side of the stream. Distances are marked on a tagged wire above the cable. The channel is straight for 1,000 feet above, and 300 feet below the station. The current has a rapid velocity at the gaging section which increases about 200 feet below. Both banks are steep mountain slopes and will not overflow. There is one channel at all stages. The bed of the stream is composed of granite bowlders at sides and cobblestones and gravel between, and is not subject to change.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements on Gunnison River near Cimarron, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 8	L. E. Foster	92	245	2.30	4.10	564
April 26	McConnell and Foster	95	474	4.26	7.10	2,018
May 6	R. I. Meeker	90	412	3.67	6.40	1,514
May 24	L. E. Foster	135	1,119	6.20	12.40	6,940
June 6	R. I. Meeker	80	511	4.76	7.95	2,435
June 17	L. E. Foster	85	632	5.65	9.45	3,569
June 28	do	85	488	4.22	7.45	2,060
July 8	R. I. Meeker	90	344	3.53	6.00	1,214
July 20	L. E. Foster	90	254	3.05	5.00	775
August 1	do	80	309	3.40	5.70	1,050
August 13	R. I. Meeker	94	373	3.37	6.25	1,258
September 2	L. E. Foster	90	401	3.56	6.58	1,427
September 14	R. I. Meeker	75	246	2.63	4.60	648

Mean daily gage height, in feet, of Gunnison River near Cimarron, Colo., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.[a]	Nov.[a]	Dec.[a]
1	4.00	3.80	7.20	9.90	6.95	5.75	6.65	6.10	4.45	3.80
2	4.00	4.00	6.90	9.95	6.95	5.75	6.50	5.92	4.42	4.05
3	3.95	4.00	6.55	9.60	6.60	5.85	6.25	5.52	4.50	4.20
4	4.00	4.10	6.50	8.85	6.55	5.95	6.05	5.45	4.55	4.10
5	3.90	4.10	6.50	8.30	6.30	6.00	5.70	5.25	4.48	.....
6	3.90	4.00	6.40	7.95	6.05	6.25	5.45	5.60	4.30	.....
7	4.15	4.10	6.45	8.15	6.05	6.45	5.10	6.35	4.35	.....
8	4.20	4.10	6.75	8.25	6.05	5.65	5.10	6.10	4.25	.....
9	4.25	4.10	7.00	8.55	5.85	5.55	4.95	6.48	4.32	.....
10	4.30	4.50	7.20	8.80	5.75	5.40	4.90	6.45	4.20	.....
11	4.30	4.55	7.40	8.80	5.60	5.55	4.73	6.20	3.70	.....
12	4.30	5.25	7.85	8.50	5.45	5.65	4.65	5.95	3.30	.....
13	4.30	6.05	9.10	8.90	5.40	5.65	4.67	5.82	3.30	.....
14	4.30	6.70	9.90	9.50	5.30	5.70	4.70	5.80	3.30	.....
15	4.20	7.30	9.65	9.75	5.35	5.85	4.58	5.70	3.30	.....
16	4.20	7.40	9.40	9.95	5.55	5.80	4.48	5.55	3.30	.....
17	4.10	7.70	9.60	9.75	5.40	5.93	4.48	5.50	3.30	.....
18	4.00	8.05	9.65	9.20	5.25	6.63	4.50	5.40	3.30	.....
19	4.00	8.40	9.85	8.90	5.05	6.55	4.42	5.00	3.30	.....
20	4.00	8.10	9.85	8.50	4.95	6.10	4.35	5.00	3.30	.....
21	4.00	7.30	9.85	8.20	4.85	5.80	4.35	5.00	3.45	.....
22	4.00	6.70	10.80	7.95	4.75	5.80	4.55	5.10	3.40	.....
23	3.90	6.40	11.30	7.60	4.70	5.60	4.70	5.05	3.45	.....
24	3.90	6.40	12.25	7.55	4.80	5.95	4.98	5.10	3.30	.....
25	3.80	6.30	11.85	7.50	4.80	6.25	4.90	4.98	3.38	.....
26	3.80	6.75	12.15	7.50	4.80	6.25	4.80	4.90	3.48	.....
27	3.80	7.70	11.15	7.55	4.80	6.10	4.75	4.75	3.45	.....
28	3.70	7.80	10.55	7.40	4.65	6.15	4.78	4.70	3.60	.....
29	3.70	7.70	10.00	7.35	5.05	6.00	4.80	4.65	4.00	.....
30	3.70	7.60	10.00	7.25	5.65	6.15	5.50	4.62	4.10	.....
31	3.70	.....	10.00	.....	5.90	6.00	.....	4.50	.....	.....

[a] Ice conditions October 19 to December 31.

Rating table for Gunnison River near Cimarron, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.70	410	4.70	685	5.80	1,070	7.80	2,280
3.80	430	4.80	715	6.00	1,170	8.00	2,420
3.90	450	4.90	745	6.20	1,270	8.50	2,820
4.00	475	5.00	775	6.40	1,370	9.00	3,250
4.10	505	5.10	805	6.60	1,490	9.50	3,700
4.20	535	5.20	835	6.80	1,610	10.00	4,180
4.30	565	5.30	870	7.00	1,730	10.50	4,700
4.40	595	5.40	910	7.20	1,860	11.00	5,250
4.50	625	5.50	950	7.40	2,000	11.50	5,850
4.60	655	5.60	990	7.60	2,140	12.00	6,450

The above table is applicable only for open-channel conditions. It is based upon 17 discharge measurements made during 1903 and 1904. It is well defined between gage heights 4.10 feet and 12.40 feet. The table has been extended below gage height 4.10 feet.

Estimated monthly discharge of Gunnison River near Cimarron, Colo., for 1904.

[Drainage area, 3,844 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March	565	410	484	29,760	0.126	0.145
April	2,740	430	1,368	81,400	.356	.400
May	6,750	1,370	3,474	213,600	.904	1.04
June	4,130	1,895	2,890	172,000	.752	.839
July	1,700	670	995	61,180	.259	.298
August	1,520	910	1,146	70,460	.298	.343
September	1,520	580	805	47,900	.209	.233
October [a]	1,430	625	951	58,470	.247	.285
November [a]	640	330	437	26,000	.114	.127
The period				760,800		

[a] Ice conditions October 19 to November 30. Estimates are for open channel.

GUNNISON RIVER NEAR CORY, COLO.

This station was established April 30, 1903, by W. N. Sammis, assisted by F. Cogswell. It is located at the highway bridge on the road between Delta and Cory, Colo., and is about 6 miles east of Delta, Colo. It is about 1 mile above the mouth of Surface Creek. The chain gage is located on the downstream side of the right span, 90 feet from the right bank. The gage reads from zero to 20 feet with two markers, the second marker being used above 10-foot gage heights. The length of chain from end of weight to center of first marker is 24.12 feet, to center of second marker 14.12 feet. The gage is read twice each day by John Shea. Discharge measurements are made from the two-span highway bridge and its approach. The initial point for soundings is a brass tack in the hand rail at center of left pier, downstream side of bridge. The channel is straight for 300 feet above and 500 feet below the station. The right bank is high, wooded, and will not overflow. The left bank is low, and wooded, but will not overflow except at extreme high water. There is but one channel at all stages. The bed of the stream is composed of bowlders and cobble stones. The bench mark is the top edge of iron rim of the northwest pier, downstream side of bridge, marked at point of bench mark by white paint. The zero of the gage is 17.59 feet below the bench mark.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Gunnison River near Cory, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Second-ft.*
April 12	L. E. Foster	188	692	2.15	6.45	1,490
April 22	do	203	952	3.32	7.58	3,160
May 2	R. I. Meeker	204	991	3.82	7.88	3,789
May 30	L. E. Foster	223	1,312	4.91	9.15	6,437
June 9	R. I. Meeker	214	1,117	4.03	8.30	4,506
June 24	L. E. Foster	212	998	3.94	8.00	3,937
July 2	do	195	833	2.64	7.10	2,201
July 12	R. I. Meeker	190	689	2.08	6.42	1,430
July 27	L. E. Foster	185	568	1.42	5.90	805
August 4	do	190	651	2.03	6.35	1,321
August 25	do	189	622	1.85	6.20	1,153
September 19	R. I. Meeker	189	593	1.45	5.80	860

Mean daily gage height, in feet, of Gunnison River near Cory, Colo., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.45	5.55	5.60	5.80	8.15	9.30	7.15	6.20	6.80	6.05	5.80	5.45
2	5.45	5.55	5.60	5.80	8.05	8.95	7.05	6.60	6.95	6.25	5.85	5.45
3	5.45	5.55	5.60	5.80	7.65	8.65	6.95	6.35	6.65	6.40	5.80	5.55
4	5.45	5.55	5.60	5.75	7.45	8.45	6.95	6.40	6.45	6.15	5.80	5.45
5	5.45	5.55	5.60	5.75	7.35	8.05	6.75	6.35	6.40	6.10	5.80	5.35
6	5.45	5.55	5.65	5.70	7.35	7.90	6.55	6.35	6.30	6.20	5.75	5.35
7	5.45	5.55	5.65	5.70	7.65	7.80	6.35	6.40	6.20	6.40	5.80	5.25
8	5.45	5.55	5.70	5.70	7.85	7.85	6.45	6.25	6.05	6.60	5.75	5.25
9	5.45	5.55	5.70	5.75	7.70	8.30	6.45	6.05	6.00	6.65	5.65	5.25
10	5.45	5.55	5.70	5.70	7.90	8.30	6.45	6.05	6.00	6.80	5.58	5.20
11	5.45	5.55	5.60	5.80	8.30	8.20	6.45	6.00	5.95	6.80	5.50	5.30
12	5.45	5.55	5.65	6.05	8.70	8.50	6.50	6.15	5.95	6.70	5.40	5.25
13	5.45	5.55	5.70	6.70	9.30	8.90	6.35	6.05	5.85	6.55	5.45	5.35
14	5.45	5.55	5.70	7.10	9.40	9.00	6.30	6.05	5.85	6.35	5.40	5.35
15	5.45	5.45	5.65	7.40	9.15	8.80	6.15	6.25	5.85	6.35	5.45	5.35
16	5.45	5.45	5.60	7.65	8.75	8.70	6.10	6.35	5.85	6.35	5.40	5.30
17	5.45	5.55	5.60	7.90	8.65	8.60	6.15	6.35	5.85	6.30	5.40	5.25
18	5.45	5.55	5.70	7.90	8.90	8.50	6.15	6.35	5.90	6.25	5.45	5.25
19	5.55	5.45	5.70	8.20	9.20	8.60	6.15	6.45	5.80	6.25	5.50	5.35
20	5.55	5.45	5.80	8.10	9.50	8.40	6.05	6.55	5.80	6.15	5.45	5.30
21	5.55	5.45	5.90	8.25	9.25	8.20	5.85	6.40	5.80	6.05	5.40	5.25
22	5.55	5.45	5.60	7.75	9.25	8.15	5.95	6.40	5.90	6.05	5.45	5.35
23	5.55	5.50	5.60	7.30	9.70	8.20	5.85	6.35	6.00	6.15	5.40	5.35
24	5.55	5.55	5.60	7.25	10.20	8.05	5.90	6.35	6.15	6.10	5.35	5.40
25	5.55	5.55	5.60	7.20	10.30	7.90	5.90	6.20	6.10	6.00	5.35	5.40
26	5.55	5.60	5.55	7.35	9.45	7.65	5.85	6.25	6.00	6.05	5.45	5.35
27	5.55	5.60	5.50	7.65	9.35	7.40	5.90	6.55	5.95	5.95	5.45	5.30
28	5.55	5.60	5.60	8.30	9.20	7.25	5.85	6.45	6.05	5.95	5.45	5.20
29	5.55	5.60	5.60	8.55	9.05	7.20	5.85	6.50	6.05	6.00	5.40	5.05
30	5.55	.....	5.70	8.40	9.15	7.20	5.90	6.50	6.05	5.90	5.45	5.15
31	5.55	.....	5.70	.....	9.20	.....	5.85	6.55	.....	5.85	.....	5.25

NOTE.—Slush ice during December.

Rating table for Gunnison River near Cory, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.50	540	6.80	1,930	8.10	4,220	9.40	7,450
5.60	620	6.90	2,080	8.20	4,440	9.50	7,760
5.70	700	7.00	2,230	8.30	4,670	9.60	8,080
5.80	790	7.10	2,380	8.40	4,900	9.70	8,400
5.90	880	7.20	2,530	8.50	5,140	9.80	8,720
6.00	970	7.30	2,690	8.60	5,380	9.90	9,050
6.10	1,070	7.40	2,860	8.70	5,620	10.00	9,390
6.20	1,180	7.50	3,040	8.80	5,860	10.10	9,750
6.30	1,290	7.60	3,220	8.90	6,110	10.20	10,110
6.40	1,400	7.70	3,410	9.00	6,360	10.30	10,480
6.50	1,520	7.80	3,610	9.10	6,610	10.40	10,860
6.60	1,650	7.90	3,810	9.20	6,880	10.50	11,260
6.70	1,790	8.00	4,010	9.30	7,160		

The above table is applicable only for open-channel conditions. It is based upon 22 discharge measurements made during 1903 and 1904, and is well defined between gage heights 5.70 feet and 9.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Gunnison River near Cory, Colo., for 1904.

[Drainage area, 5,233 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	580	500	534	32,830	0.102	0.117
February	620	500	568	32,670	.109	.118
March	880	540	658	40,460	.126	.145
April	5,260	700	2,422	144,100	.463	.516
May	10,480	2,775	5,905	363,100	1.13	1.30
June	7,160	2,530	4,594	273,400	.878	.980
July	2,455	835	1,287	79,140	.246	.284
August	1,650	970	1,321	81,230	.252	.290
September	2,155	790	1,079	64,200	.206	.230
October	1,930	835	1,248	76,740	.238	.274
November	835	470	578	34,390	.110	.123
December	580	310	422	25,950	.081	.093
The year	10,480	360	1,718	1,248,000	.328	4.47

GUNNISON RIVER AT WHITEWATER, COLO.

This station was established by J. E. Field, April 10, 1902, at the two-span steel wagon bridge constructed by the State of Colorado at a point about half a mile above the railroad station at Whitewater, on the Denver and Rio Grande Railroad. During 1895, 1897, and 1901 incomplete series of gage heights were obtained at this point, but the station was not regularly established until 1902. It was intended that this station should take the place of the one formerly maintained on the Gunnison at Grand Junction. The latter station was abandoned on account of inaccuracies that could not be overcome. They were mainly due to the fact that high stages of water in Grand River affected the gage rod in the Gunnison, and that the stream bed was partially filled with great bowlders, making accurate gagings impossible. The gage as originally established was of wire, on the downstream side of right span. On April 8, 1904, the old gage was replaced by a new chain gage with the same datum. The gage scale is graduated from zero to 10 feet, with two markers on the chain, giving a range of 20 feet in gage heights. The length of chain from end of weight to center of first marker is 21.59 feet. The second marker is 11.59 feet from end of weight and is used when the gage heights are above 10 feet. The gage is read twice each day by James Page, station agent at Whitewater. Discharge measurements are made from the downstream side of the bridge. The bed of the stream at cross section is good, being composed of sand, gravel, and cobblestones which are fairly permanent. There is a small area adjacent to some old sheet piling about the cylinder piers in the center of the river which fills in with silt during low water and scours out during high water. The width of section is 282 feet between masonry piers. At the center of the section the current is broken by cylinder piers and old sheet piling. The initial point for soundings is the edge of the capstone of the left masonry abutment on the downstream side of bridge.

The channel is straight for several hundred feet above and below the station. The right bank is high and not liable to overflow. The left bank will overflow at very high stages. On July 3, 1904, a standard United States Geological Survey iron bench mark was established by the topographic branch of the United States Geological Survey about 40 feet southeast of east end of bridge. It is stamped 4,653.6 feet above sea level. The zero of the gage is 16.83 feet below the bench mark.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Gunnison River at Whitewater, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 8	R. I. Meeker	190	374	2.26	4.00	844
April 29	do	265	1,263	3.69	7.05	4,656
June 3	do	282	1,397	3.89	7.55	5,438
July 3	do	257	831	2.67	5.45	2,220
August 9	G. B. Monk	255	537	2.08	4.57	1,118
August 9	R. I. Meeker	255	533	2.13	4.55	1,135
September 8	do	253	528	2.21	4.55	1,166

Mean daily gage height, in feet, of Gunnison River at Whitewater, Colo., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.80	4.20	3.95	4.20	6.75	8.25	6.20	5.05	6.15	4.50
2	3.80	4.10	3.85	3.90	6.85	7.90	5.85	5.45	5.85	4.55
3	3.80	4.00	3.80	3.90	6.60	7.50	5.50	5.25	5.20	4.65
4	3.90	4.15	3.75	3.90	6.65	7.40	5.40	5.00	5.00	4.85
5	3.95	4.25	3.80	3.80	6.30	7.00	5.40	5.80	4.90	4.65
6	4.00	4.45	3.85	3.80	6.00	6.50	5.30	4.65	4.80	4.70
7	4.05	4.40	3.85	3.90	6.10	6.35	5.20	4.80	4.70	4.90
8	4.10	4.30	3.95	4.00	6.50	6.55	5.05	4.70	4.55	5.70
9	4.10	4.30	3.90	3.90	6.45	6.95	4.85	4.52	4.40	5.45
10	4.05	4.20	4.15	3.90	6.70	7.10	4.70	4.65	4.35	5.30
11	4.10	4.20	4.00	4.20	6.90	7.25	4.70	4.80	4.25	5.20
12	4.00	4.10	3.95	4.55	7.30	7.35	4.60	4.60	4.20	5.15
13	3.90	4.00	3.90	5.05	7.80	7.65	4.45	4.55	4.10	5.00
14	3.90	4.00	3.80	5.40	8.35	7.85	4.35	4.80	4.00	5.00
15	3.95	4.05	3.80	5.75	8.35	7.70	4.25	4.95	4.00	4.90
16	4.05	4.15	3.90	6.10	7.90	7.55	4.20	5.15	4.00	4.80
17	4.15	4.20	3.90	6.35	7.65	7.45	4.05	5.35	4.20	4.80
18	4.10	4.10	3.85	6.55	7.70	7.30	4.05	5.55	4.10	4.70
19	4.00	4.10	3.80	6.80	8.10	7.05	4.20	5.35	4.10	4.60
20	3.90	4.20	3.90	6.85	8.50	6.80	4.10	5.25	4.00	4.55
21	3.90	4.05	4.00	6.50	8.40	7.35	4.00	5.05	4.00	4.55
22	4.05	3.85	4.25	6.60	8.20	7.35	3.90	4.90	4.15	4.45
23	4.25	3.90	4.30	6.05	8.25	7.05	4.05	4.80	4.30	4.30
24	4.25	3.85	4.20	5.85	8.75	6.75	4.10	4.80	4.30	4.35
25	4.10	4.00	4.05	5.60	9.05	6.55	4.20	4.65	4.40	4.30
26	4.00	4.00	3.90	5.55	8.60	6.40	4.35	4.60	4.45	4.35
27	3.90	3.90	3.80	6.05	8.00	6.10	4.45	4.85	4.30	4.25
28	4.05	4.00	3.80	6.55	7.95	5.95	4.55	5.05	4.10	4.10
29	4.25	4.05	3.70	7.05	7.70	5.80	4.65	5.25	4.15	4.10
30	4.40	.....	3.85	7.05	7.80	5.75	4.75	5.40	4.35	4.15
31	4.30	.....	4.05	.....	8.15	.....	4.95	5.50	.....	4.05

Rating table for Gunnison River at Whitewater, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.70	510	5.10	1,740	6.40	3,530	7.70	5,800
3.80	570	5.20	1,860	6.50	3,690	7.80	5,990
3.90	630	5.30	1,985	6.60	3,850	7.90	6,180
4.00	695	5.40	2,110	6.70	4,010	8.00	6,380
4.10	765	5.50	2,240	6.80	4,180	8.10	6,580
4.20	840	5.60	2,370	6.90	4,350	8.20	6,780
4.30	920	5.70	2,505	7.00	4,520	8.30	6,990
4.40	1,005	5.80	2,640	7.10	4,690	8.40	7,200
4.50	1,095	5.90	2,780	7.20	4,870	8.50	7,420
4.60	1,190	6.00	2,920	7.30	5,050	8.60	7,640
4.70	1,290	6.10	3,070	7.40	5,230	8.70	7,860
4.80	1,395	6.20	3,220	7.50	5,420	8.80	8,080
4.90	1,505	6.30	3,370	7.60	5,610	8.90	8,300
5.00	1,620						

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904. It is well defined between gage heights 4.50 feet and 8.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Gunnison River at Whitewater, Colo., for 1904.

[Drainage area, 7,868 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	1,005	570	724	44,520	0.092	0.106
February	1,050	600	774	44,520	.098	.106
March	920	510	648	39,840	.082	.095
April	4,605	570	2,248	133,800	.286	.319
May	8,630	2,920	5,623	345,700	.715	.824
June	6,885	2,572	4,602	273,800	.585	.653
July	3,220	630	1,319	81,100	.168	.194
August	2,640	1,095	1,642	101,000	.209	.241
September	3,145	695	1,104	65,690	.140	.156
October	2,505	730	1,301	80,000	.165	.190
The period				1,210,000		

CIMARRON RIVER AT CIMARRON, COLO.

This station was established April 28, 1903, by W. N. Sammis. It is located at the footbridge 1,200 feet south of the Denver and Rio Grande Railroad station and about 1 mile above the entry of Cimarron River into Gunnison River. The gage is a vertical 1 by 6 inch rod, fastened to the left abutment on the downstream side. The gage is graduated to feet and tenths and reads from zero to 7 feet. It is read twice each day by G. L. Linscott. Discharge measurements are made from the footbridge, which is supported by two log abutments and one log pier in the center of the stream. The initial point for soundings is the left abutment on the downstream side. The channel is straight for 100 feet above and 250 feet below the station. Both banks are low and partly wooded, and have not been known to overflow for the past eight years. At low water there is but one channel, and all the water passes beneath the left span. At high water there are two channels, separated by the center pier of the bridge. The bed of the stream is stable and very rough, and is composed of large cobblestones and bowlders. The stream gradient is large, though somewhat uneven. The velocity at the section is always high. The drainage area is entirely mountainous. During summer and fall short heavy rain storms occur frequently and cause sudden fluctuations in gage heights, due to the rapid run-off induced by steep slopes of drainage basin. The bridge has a span between abutments of about 60 feet. The bench mark consists of two nails driven into the root of a cottonwood tree 50 feet west of the gage. Its elevation is 7.82 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Cimarron River at Cimarron, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 8	L. E. Foster	32	28	1.46	1.65	41
April 16	Foster and Meeker	32	47	4.49	2.25	211
April 27	McConnell and Foster	32	50	3.88	2.10	194
June 7	R. I. Meeker	43	79	4.90	2.75	387
June 16	L. E. Foster	46	80	5.32	2.88	426
June 27	do	31	47	4.38	2.25	206
July 9	R. I. Meeker	31	34	3.76	2.10	127
July 22	L. E. Foster	30	26	2.65	1.75	69
August 2	do	30	28	3.00	1.85	84
August 10	do	30	19	2.05	1.60	39
September 3	do	33	38	3.94	2.20	150
September 15	R. I. Meeker	33	22	2.55	1.75	56

Mean daily gage height, in feet, of Cimarron River at Cimarron, Colo., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.70	2.25	3.02	2.20	1.85	2.60	1.98	1.70
2	.....	1.70	2.22	2.98	2.05	1.88	1.98	1.90	1.60
3	.....	1.70	2.10	2.85	2.08	1.82	2.00	1.95	1.50
4	.....	1.70	2.05	2.70	2.05	1.80	2.12	1.85	1.60
5	.....	1.70	2.10	2.48	2.20	1.80	1.95	1.75	1.55
6	.....	1.65	2.10	2.50	2.15	1.80	1.95	1.80	1.60
7	.....	1.62	2.18	2.72	2.02	1.80	1.98	1.90	1.70
8	.....	1.62	2.20	2.78	2.10	1.78	1.92	1.85	1.60
9	.....	1.60	2.25	2.82	2.15	1.72	1.95	1.90	1.60
10	.....	1.62	2.55	2.72	2.05	1.60	1.75	1.90	1.50
11	.....	1.85	2.58	3.00	2.00	1.68	1.85	1.92	(a)
12	.....	2.10	2.75	3.05	2.10	1.70	1.85	1.82	(a)
13	.....	2.20	2.90	3.35	1.92	1.62	1.85	1.88	(a)
14	.....	2.20	2.90	3.40	1.92	1.78	1.82	1.78	(a)
15	.....	2.30	2.80	3.05	1.92	1.60	1.78	1.85	(a)
16	.....	2.28	2.58	2.98	1.90	1.52	1.90	1.80	1.80
17	.....	2.32	2.60	3.00	1.98	1.52	1.82	1.85	2.00
18	.....	2.40	2.80	2.80	1.88	2.45	1.78	1.75	1.80
19	.....	2.42	3.05	2.65	1.85	2.00	1.78	b 1.70	(a)
20	.....	2.28	3.05	2.92	1.80	1.80	1.82	1.70	(a)
21	.....	2.35	3.05	2.90	1.78	1.85	1.75	1.65	.....
22	.....	2.10	3.12	2.75	1.75	1.95	1.70	1.60	.....
23	.....	2.10	3.30	2.65	1.78	1.78	1.70	1.65	.....
24	1.75	2.05	3.38	2.70	1.98	1.95	1.95	1.65	.....
25	1.75	1.95	3.20	2.65	1.80	1.82	1.65	1.60	.....
26	1.80	2.10	2.92	2.85	1.78	2.10	1.72	1.60	.....
27	1.75	2.18	3.08	2.30	1.80	2.00	1.82	1.65	.....
28	1.75	2.40	3.08	2.35	1.78	2.18	1.70	1.70	.....
29	1.72	2.48	3.08	2.38	1.88	1.85	1.75	1.70	.....
30	1.70	2.28	3.32	2.30	2.12	1.98	1.95	1.55	.....
31	1.62	.....	3.12	.....	1.92	2.05	.....	1.55	.....

a River frozen. b Ice conditions October 19 to December 31.

Rating table for Cimarron River at Cimarron, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.55	33	1.85	83	2.30	199	2.90	445
1.60	40	1.90	93	2.40	233	3.00	495
1.65	48	1.95	104	2.50	270	3.10	545
1.70	56	2.00	115	2.60	310	3.20	595
1.75	64	2.10	140	2.70	353	3.30	645
1.80	73	2.20	168	2.80	398	3.40	705

The above table is applicable only for open-channel conditions. It is based upon 13 discharge measurements made during 1904 and 3 high-water measurements made in 1903. It is not well defined, owing to the roughness of the channel.

Estimated monthly discharge of Cimarron River at Cimarron, Colo., for 1904.

[Drainage area, 210 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March 24–31	73	43	60.9	968	0.290	0.087
April	262	40	135	8,033	.643	.717
May	693	127	387	23,800	1.84	2.12
June	785	199	402	23,920	1.91	2.13
July	168	64	108	6,641	.514	.593
August	251	29	85.2	5,238	.405	.467
September	310	48	91.1	5,420	.433	.483
October[a]	111	33	68.6	4,218	.329	.380
November 1–10[a]	56	26	39.7	787	.189	.070
The period				79,020		

[a] Estimates are for open channel October and November.

GUNNISON RIVER (NORTH FORK) NEAR HOTCHKISS, COLO.

This station, as originally established May 2, 1903, by W. N. Sammis, was located at the highway bridge one-half mile east of Hotchkiss, Colo. The gage was a vertical 2 by 4 inch rod, 3 feet long, nailed to the upstream side of the log abutment on the right bank. Another 3-foot section was nailed to the middle pier on the downstream side. This gage was read twice each day by Frank Visner. Discharge measurements were made from the two-span highway bridge and its approach. The initial point for soundings was the end of the hand rail on the downstream side at the left bank. The channel was straight for about 100 feet above and below the station, and the current was swift. The right bank was low and liable to overflow. The left bank was high and was not liable to overflow. The bed of the stream was rocky. The bench mark for this station was a bolt on the upstream side of the southwest pier on the right bank. It was marked "B. M. U. S. G. S." Its elevation was 8.58 feet above the zero of the gage.

Owing to unsatisfactory conditions, the station at the highway bridge was abandoned and a new station established April 13, 1904, by R. I. Meeker. It is located 4 miles below Hotchkiss, Colo., on the ranch of L. Gorsuch. The gage is an inclined 2 by 6 inch timber, graduated from zero to 7 feet in feet and tenths. It is located on the right bank about 1,000 feet downstream from the house of the observer, L. Gorsuch, who reads the gage twice each day.

It is held in place by 2 by 4 inch stakes and bowlders. Discharge measurements are made by means of a five-eighths inch iron wire cable and car, the property of the observer. The initial point for soundings is near the left end of cable, marked "0.0" with brass tag on the wire, which has the points for soundings marked with brass tags every 10 feet. The channel is straight for about 800 feet above and below the station and the current is swift. Both banks are low and rocky and are not liable to overflow. The right bank is clean and the left bank is partly wooded. The bed of the stream is composed of large and small cobblestones and some gravel, and is permanent. There are two channels at low, and one at high water. The drainage area is mountainous. In August and September practically the entire discharge of the river is diverted for irrigation above. The bench mark is a point on a large bowlder designated by a circle of white paint and marked "B. M." It is on the right bank of the stream, about 50 feet to the right of the gage. Its elevation is 9.34 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Gunnison River (North Fork) near Hotchkiss, Colo., in 1904.

Date.	Hydrographer	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 13	R. I. Meeker	143	190	3.43	2.90	652
May 4	do	168	285	3.98	3.40	1,133
June 1	L. E. Foster	170	386	4.33	3.70	1,673
June 10	R. I. Meeker	164	256	3.97	3.28	1,017
June 24	L. E. Foster	135	230	3.42	3.10	786
July 13	R. I. Meeker	85	67	2.25	2.30	151
August 5	L. E. Foster	70	54	2.11	2.20	114
August 24	do	70	64	2.34	2.30	150
September 18	R. I. Meeker	68	48	2.08	2.15	100

Mean daily gage height, in feet, of Gunnison River (North Fork) near Hotchkiss, Colo., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.90	2.00	2.70	2.40	3.78	3.68	2.78	2.22	2.88	2.58	2.25	2.20
2	2.90	2.00	2.65	2.30	3.65	3.55	2.75	2.25	2.75	2.52	2.22	2.20
3	2.90	2.00	2.60	2.30	3.52	3.55	2.65	2.28	2.52	2.48	2.20	2.20
4	2.90	2.00	2.60	2.30	3.48	3.42	2.60	2.18	2.42	2.40	2.25	2.25
5	2.90	2.00	2.60	2.40	3.42	3.60	2.60	2.20	2.38	2.35	2.28	2.28
6	2.90	2.00	2.60	2.40	3.45	3.32	2.60	2.20	2.30	2.40	2.25	2.30
7	2.90	2.00	2.60	2.40	3.75	3.25	2.55	2.20	2.30	2.70	2.25	2.30
8	2.90	2.00	2.55	2.50	3.70	3.32	2.55	2.12	2.30	2.68	2.20	2.30
9	2.90	2.00	2.45	2.50	3.70	3.45	2.50	2.30	2.22	2.65	2.20	2.25
10	2.90	2.00	2.40	2.50	3.88	3.32	2.42	2.18	2.20	2.62	2.20	2.20
11	2.90	2.00	2.30	2.60	4.05	3.45	2.40	2.12	2.20	2.60	2.28	2.20
12	2.90	2.00	2.20	2.60	4.32	3.50	2.32	2.10	2.15	2.60	2.32	2.20
13	2.90	2.00	2.20	2.90	4.40	3.60	2.30	2.25	2.10	2.60	2.32	2.20
14	2.90	2.20	2.20	3.08	4.38	3.58	2.30	2.35	2.08	2.55	2.30	2.15
15	2.90	2.40	2.40	3.30	4.15	3.52	2.28	2.50	2.05	2.55	2.25	2.18
16	2.90	2.45	2.40	3.32	4.00	3.52	2.20	2.40	2.10	2.50	2.25	2.22
17	2.90	2.60	2.40	3.40	4.08	3.50	2.20	2.40	2.10	2.50	2.25	2.30
18	2.90	2.70	2.50	3.52	4.10	3.42	2.18	2.52	2.18	2.45	2.20	2.35
19	2.90	2.70	2.50	3.68	4.15	3.28	2.15	2.58	2.20	2.45	2.20	2.30
20	2.90	2.70	2.50	3.42	4.12	3.40	2.12	2.50	2.20	2.40	2.20	2.25
21	2.90	2.70	2.60	3.62	3.95	3.35	2.32	2.55	2.20	2.40	2.20	2.20
22	2.90	2.70	2.60	3.32	3.98	3.22	2.05	2.40	2.20	2.40	2.25	2.18
23	2.90	2.80	2.60	3.28	4.10	3.15	2.00	2.38	2.42	2.40	2.25	2.15
24	2.90	2.80	2.60	3.25	4.22	3.10	2.08	2.30	2.60	2.35	2.30	2.20
25	2.90	2.80	2.60	3.20	4.02	3.05	2.00	2.32	2.42	2.35	2.30	2.20
26	2.90	2.80	2.60	3.32	3.90	2.98	2.00	2.35	2.40	2.35	2.30	2.20
27	2.90	2.80	2.60	3.55	3.88	2.95	1.98	2.30	2.38	2.32	2.25	2.10
28	2.90	2.80	2.50	3.88	3.72	2.88	1.95	2.32	2.35	2.30	2.25	2.18
29	2.90	2.80	2.50	3.95	3.65	2.88	2.00	2.40	2.35	2.30	2.25	2.20
30	2.90	.....	2.40	3.65	3.65	2.85	2.25	2.32	2.45	2.30	2.20	2.25
31	2.00	.....	2.40	.....	3.80	.....	2.35	2.32	.....	2.25	.....	2.25

Rating table for Gunnison River (North Fork) near Hotchkiss, Colo., from May 3, 1903, to April 12, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	45	2.80	394	4.00	1,395	5.10	3,220
1.70	55	2.90	443	4.10	1,530	5.20	3,430
1.80	70	3.00	495	4.20	1,675	5.30	3,655
1.90	88	3.10	550	4.30	1,825	5.40	3,890
2.00	108	3.20	610	4.40	1,980	5.50	4,140
2.10	133	3.30	680	4.50	2,140	5.60	4,400
2.20	162	3.40	760	4.60	2,305	5.70	4,670
2.30	195	3.50	845	4.70	2,475	5.80	4,950
2.40	230	3.60	940	4.80	2,650	5.90	5,240
2.50	267	3.70	1,045	4.90	2,830	6.00	5,530
2.60	306	3.80	1,155	5.00	3,020	6.10	5,820
2.70	348	3.90	1,270				

The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1903 and is well defined.

Rating table for Gunnison River (North Fork) near Hotchkiss, Colo., from April 13 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.95	52	2.35	171	3.10	785	3.80	1,850
2.00	61	2.40	195	3.20	910	3.90	2,030
2.05	72	2.50	255	3.30	1,050	4.00	2,210
2.10	85	2.60	325	3.40	1,190	4.10	2,390
2.15	100	2.70	395	3.50	1,340	4.20	2,570
2.20	116	2.80	475	3.60	1,500	4.30	2,770
2.25	133	2.90	570	3.70	1,670	4.40	2,970
2.30	151	3.00	675				

The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements made during 1904. It is well defined between gage heights 2.15 feet and 3.70 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Gunnison River (North Fork) near Hotchkiss, Colo., for 1904.

[Drainage area, 850 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	443	108	432	26,560	0.508	0.585
February	394	108	236	13,580	.277	.300
March	348	162	267	16,420	.314	.362
April	2,120	195	850	50,580	1.00	1.12
May	2,970	1,218	2,041	125,500	2.40	2.77
June	1,632	520	1,102	65,570	1.30	1.45
July	459	52	180	11,070	.212	.244
August	311	85	166	10,200	.195	.225
September	550	72	174	10,350	.205	.229
October	395	133	239	14,700	.281	.325
November	159	116	132	7,855	.155	.173
December	171	85	125	7,686	.147	.170
The year	2,970	52	495	360,100	.583	7.95

UNCOMPAHGRE RIVER NEAR COLONA, COLO.

This station was originally established April 23, 1903, by W. N. Sammis. It was located at a highway bridge one-half mile northeast of Colona, Colo. The gage consisted of a vertical 2 by 4 inch timber spiked to the log abutment on the downstream side near the left bank. Gage readings were taken twice each day by Chester Olsen, from April 26 to August 10, 1903. Discharge measurements were made from the two-span bridge to which the gage was attached. The initial point for soundings was the face of the log abutment on the left bank, at the downstream side. The bench mark is a nail in a cottonwood tree 6 inches in diameter and 50 feet northwest of the gage. It is marked "B. M. U. S. G. S." Its elevation is 9.65 feet above the zero of the gage.

On August 2, 1903, a dam was put in below the station for the purpose of diverting the water for irrigation. This backed up the water on the gage, and the station was discontinued August 10. It was reestablished on the same date by W. N. Sammis at Sam S. Kettle's bridge, about 1 mile south of Colona, Colo. The new gage is a vertical 2 by 4 inch timber nailed to the center pier of the two-span bridge, on the upstream side. It is read twice each day by Sam S. Kettle. Discharge measurements are made from the two-span wooden highway bridge at which the gage is located. The initial point for soundings is the face of the right abutment, on the downstream side of the bridge. The channel is straight for 100 feet above and for 50 feet below the station. The right bank is low and overflows at high water for a distance of 130 feet. The left bank is high and rocky and will not overflow. The bed of the stream is composed of gravel, free from vegetation, and is shifting. There are two channels at low and at high water. The bridge has a total span of about 60 feet between abutments. The bench mark is a nail driven in a blaze on a cottonwood tree. The tree is about 4 inches in diameter, and is about 75 feet northeast of the gage. The elevation of the bench mark is 4.49 feet above the zero of the gage.

Owing to unsatisfactory conditions at both high and low water, the station at Kettle's bridge was abandoned, and the station was reestablished April 9, 1904, by R. I. Meeker, at the private road bridge of J. M. Duckett, one-half mile above Eldredge Siding on the Denver and Rio Grande Railway and 3 miles above Colona, Colo. It is best reached by driving from Montrose. The gage is a 2 by 6 inch pine board 8 feet long, spiked vertically to the upstream side of the left abutment. It is graduated from zero to 7 feet in feet and tenths, the foot-marks having iron figures nailed at the side. Discharge measurements are made from the downstream side of the single span bridge, 46.2 feet long, to which the gage is attached. The initial point for

soundings is the downstream edge of the left abutment. The channel is straight for about 300 feet above and below the station. The current is swift. Both banks are rocky, partly wooded, and not subject to overflow. The bed of the stream is composed of rock and gravel, and is clean and permanent. There is but one channel at all stages. The river has a uniform slope above and below the measuring section. The bench mark is the upper edge of a large screw set in an 8-inch willow tree about 3 feet above the ground. This tree is about 75 feet south and upstream from the right end of the bridge. Its elevation is 9.97 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Uncompahgre River near Colona, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 5 [a]	L. E. Foster		53	1.83	2.45	97
April 9	R. I. Meeker	45	38	2.26	.73	86
April 20	L. E. Foster	45	64	3.01	1.20	194
April 30 [a]	R. I. Meeker		66	2.97	2.70	196
April 30	do	45	60	3.40	1.12	204
May 26	L. E. Foster	46	99	4.21	1.90	417
June 8	R. I. Meeker	46	96	5.57	1.95	535
June 21	L. E. Foster	46	96	5.91	2.10	567
July 7	R. I. Meeker	46	74	3.86	1.58	286
July 30	L. E. Foster	46	63	2.83	1.30	178
August 12	G. B. Monk	46	67	3.13	1.35	210
August 22	L. E. Foster	46	78	4.28	1.65	334
September 1	do	46	94	6.14	2.12	577
September 13	R. I. Meeker	46	57	2.93	1.22	167

[a] Made at Kettles Crossing.

Mean daily gage height, in feet, of Uncompahgre River near Colona, Colo., for 1904.

Day.	Jan.[c]	Feb.[c]	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	[a] 3.30	3.30	2.40	2.40	1.70	2.45	1.75	.....	2.15	1.40
2	3.30	3.30	2.40	2.40	1.45	2.65	1.75	.....	2.10	1.35
3	3.30	3.20	2.40	2.40	1.70	2.30	[b] 1.75	.....	1.85	1.30
4	3.40	3.30	2.40	2.40	1.75	1.85	1.75	.....	1.75	1.30
5	3.20	3.30	2.40	2.40	1.55	1.65	1.75	.....	1.65	1.30
6	3.20	3.30	2.40	2.50	1.45	1.55	1.70	.....	1.60	1.35
7	3.30	3.35	2.40	2.40	1.70	2.10	1.50	.....	1.70	1.60
8	3.40	3.45	2.40	2.40	1.35	2.15	1.55	.....	1.35	1.40
9	3.40	3.40	2.40	2.40	1.35	2.00	1.85	.....	1.30	1.60
10	3.30	3.40	2.40	2.45	1.85	2.00	1.50	.....	1.25	1.45
11	3.40	3.40	2.40	2.60	1.60	2.00	1.45	.....	1.30	1.30
12	3.50	3.30	2.40	2.70	1.82	2.40	1.40	1.42	1.30	1.30
13	3.30	3.30	2.40	2.80	2.00	2.55	1.40	1.30	1.30	1.30
14	3.40	3.35	2.40	2.80	2.15	2.50	1.35	1.25	1.10	1.20
15	3.50	2.50	2.40	2.80	1.65	2.25	1.25	1.40	1.05	1.20
16	3.40	2.50	2.40	2.80	1.80	2.35	1.35	1.25	1.05	1.10
17	3.30	2.50	2.40	.85	1.75	2.35	.....	1.70	1.20	1.10
18	3.35	2.40	2.40	.75	1.95	2.55	.....	2.25	1.05	1.10
19	3.20	2.40	2.40	.72	2.25	[b] 2.45	.....	2.00	1.05	1.10
20	3.35	2.40	2.40	.72	2.25	2.35	.....	1.75	.90	1.10
21	3.40	2.40	2.40	.78	2.30	2.45	.....	1.75	[b] 1.10	1.10
22	3.40	2.40	2.40	.72	2.20	2.50	.....	1.65	[b] 1.18	1.10
23	3.40	2.40	2.40	.72	2.60	2.30	.....	1.60	1.25	1.10
24	3.40	2.40	2.40	1.20	2.80	2.30	.....	1.60	1.15	1.10
25	3.40	2.40	2.40	1.20	2.30	2.30	.....	1.65	1.20	1.10
26	3.40	2.40	2.40	1.10	2.25	1.95	.....	1.75	1.20	1.10
27	3.40	2.40	2.40	1.20	2.35	1.75	.....	1.80	1.20	1.10
28	3.40	2.40	2.40	2.15	2.30	1.80	.....	1.90	1.10	1.00
29	3.40	2.40	2.40	1.50	2.45	2.25	.....	2.00	1.15	1.00
30	3.40	.....	2.40	1.75	2.45	1.75	.....	2.10	1.30	1.00
31	3.30	.....	2.40	.....	2.65	.....	.....	2.05	.....	1.00

[a] Readings from January 1 to April 16, inclusive, at Kettle's bridge. After April 16 they were taken at Eldredge Siding.
[b] Estimated.
[c] Ice conditions January 1 to February 15.

Rating table for Uncompahgre River at Kettle's crossing, near Colona, Colo., from August 11, 1903, to April 16, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.20	30	2.60	149	3.00	341	3.40	533
2.30	46	2.70	197	3.10	389	3.50	581
2.40	69	2.80	245	3.20	437	3.60	629
2.50	102	2.90	293	3.30	485	3.70	677

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1903 and 1904 between gage heights 2.50 feet and 2.70 feet. Above and below these limits the table is only approximate.

Rating table for Uncompahgre River at Eldredge siding, near Colona, Colo., from April 17 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.70	64	1.20	163	2.00	530	2.70	1,130
.75	71	1.30	192	2.10	600	2.80	1,240
.80	79	1.40	228	2.20	670	2.90	1,350
.85	87	1.50	269	2.30	750	3.00	1,460
.90	96	1.60	313	2.40	835	3.10	1,570
.95	106	1.70	360	2.50	930	3.20	1,680
1.00	116	1.80	410	2.60	1,030	3.30	1,790
1.10	138	1.90	470				

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1904. It is well defined between gage heights 0.70 foot and 2.10 feet. The table has been extended above gage height 2.10 feet.

Estimated monthly discharge of Uncompahgre River near Colona, Colo., for 1904.

[Drainage area, 633 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January [a]	581	437	513	31,540	1.18	1.36
February [a]	557	69	281	16,160	.649	.700
March	69	69	69	4,243	.159	.183
April	635	69	149	8,866	.344	.383
May	1,240	209	567	34,860	1.31	1.51
June	1,080	291	691	41,120	1.60	1.78
July, 16 days	440	177	303	9,616	.700	.412
August, 20 days	710	177	382	15,150	.882	1.02
September	635	96	224	13,330	.517	.577
October	313	116	172	10,580	.397	.458
The period				185,500		

[a] Estimates January and February are for open channel.

UNCOMPAHGRE RIVER AT MONTROSE, COLO.

This station was established April 22, 1903, by A. L. Fellows. It is located at the highway bridge west of Montrose and one-fourth mile west of the Denver and Rio Grande Railroad. The gage is a vertical 1 by 8 inch timber fastened to a wing dam 20 feet above the bridge. On April 15, 1904, the old rod was replaced by a new rod graduated to feet and tenths from zero to 8 feet. The zero of the new rod is identical with 1.45 feet on the old rod. The gage is read twice each day by Herbert Reeves. Discharge measurements are made from the highway bridge. The initial point for soundings is at the lower cylinder of the bridge on the left bank. The channel is straight for 300 feet above and below the station. There is but one channel at all stages, broken by two bridge piers at high water. The left bank is low and composed of earth. The right bank is low and composed of gravel. Both banks are subject to overflow. The bed of the stream is composed of gravel and cobblestones. The bench mark consists of two nails driven into a blaze on the root of a cottonwood tree. The tree is 50 feet east of the rod. The elevation of the bench mark is 8.51 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Uncompahgre River at Montrose, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 5	McConnell and Foster	21	17	0.83	1.15	14
April 25	L. E. Foster	20	24	1.46	1.70	35
May 21	do	34	63	4.25	3.10	268
June 8	R. I. Meeker	30	44	2.91	2.45	128
June 29	L. E. Foster	28	42	2.69	2.40	113
July 7	R. I. Meeker	25	31	1.87	2.05	58
July 23	L. E. Foster	18	17	.39	1.35	6.5
August 11	G. B. Monk	26	30	1.87	2.00	56
September 1	L. E. Foster	40	76	5.21	3.55	396
September 13	R. I. Meeker	26	31	2.16	2.10	67

Mean daily gage height, in feet, of Uncompahgre River at Montrose, Colo., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	1.80	3.22	2.18	2.58	3.60	2.35	.....	2.25
2	.....	.....	.....	.....	1.58	2.65	2.18	2.65	3.42	2.15	.....	2.30
3	.....	.....	.....	.....	1.52	2.32	2.15	2.65	3.08	2.20	.....	2.30
4	.....	.....	.....	.....	2.05	2.12	2.32	2.40	2.70	2.25	.....	2.35
5	.....	.....	.....	.....	2.08	2.02	2.02	2.10	2.50	2.35	.....	2.30
6	.....	.....	.....	.....	1.90	2.22	2.28	2.00	2.45	2.75	.....	2.35
7	.....	.....	.....	.....	2.18	2.25	2.25	2.02	2.40	3.50	.....	2.40
8	.....	.....	.....	.....	1.88	2.40	2.08	1.98	2.30	3.30	.....	2.35
9	.....	.....	.....	.....	1.78	2.55	1.98	2.02	2.25	3.15	.....	2.40
10	.....	.....	.....	.....	2.05	2.48	2.25	1.92	2.00	2.35	.....	2.40
11	.....	.....	.....	.....	2.00	2.85	2.30	1.92	1.98	2.15	.....	2.40
12	.....	.....	.....	.....	2.32	3.05	2.20	1.95	1.98	2.10	.....	2.40
13	.....	.....	.....	.....	2.70	3.02	2.20	1.95	2.10	2.00	.....	2.32
14	.....	.....	.....	.....	3.05	3.15	2.15	1.90	1.98	2.00	.....	2.38
15	.....	.....	.....	.....	2.60	2.88	2.08	2.10	1.92	1.95	.....	2.40
16	.....	.....	.....	.....	2.48	2.95	2.00	1.90	1.92	1.95	.....	2.32
17	.....	.....	.....	2.35	2.22	2.65	1.98	2.20	1.85	1.50	.....	2.30
18	.....	.....	.....	2.35	2.85	3.00	1.90	3.30	1.80	1.75	.....	2.35
19	.....	.....	.....	2.30	3.15	2.92	1.85	2.85	1.80	1.75	.....	2.40
20	.....	.....	.....	1.75	3.05	3.15	1.68	2.55	1.72	1.65	.....	2.32
21	.....	.....	.....	1.90	2.92	3.15	1.50	2.35	1.78	1.70	.....	2.32
22	.....	.....	.....	1.35	2.95	2.95	1.45	2.30	1.80	1.75	.....	2.35
23	.....	.....	.....	1.50	3.55	2.72	1.38	2.25	1.90	1.80	.....	2.40
24	.....	.....	.....	1.60	3.95	2.65	1.38	2.15	1.92	1.75	.....	2.40
25	.....	.....	.....	1.65	3.40	2.60	1.40	2.10	1.82	1.75	.....	2.40
26	.....	.....	.....	1.58	3.80	2.25	1.35	2.75	1.85	1.80	.....	2.35
27	.....	.....	.....	1.62	3.18	2.18	1.40	2.60	1.85	1.72	.....	2.30
28	.....	.....	.....	2.25	3.05	2.18	1.50	2.70	1.85	1.72	.....	2.30
29	.....	.....	.....	2.22	2.68	2.25	2.70	3.00	2.52	1.75	.....	2.30
30	.....	.....	.....	1.82	3.68	2.22	2.38	3.00	2.38	1.80	.....	2.32
31	.....	.....	.....	.....	3.42	.....	2.32	2.92	.....	1.80	.....	2.30

Rating table for Uncompahgre River at Montrose, Colo., from April 17 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.35	7	1.80	37	2.40	115	3.20	294
1.40	10	1.85	42	2.50	135	3.30	322
1.45	13	1.90	47	2.60	155	3.40	351
1.50	16	1.95	52	2.70	177	3.50	381
1.55	19	2.00	57	2.80	199	3.60	412
1.60	22	2.10	69	2.90	221	3.70	444
1.65	25	2.20	82	3.00	244	3.80	476
1.70	29	2.30	97	3.10	268	3.90	510
1.75	33						

The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements made during 1904, and is well defined.

Estimated monthly discharge of Uncompahgre River at Montrose, Colo., for 1904.

[Drainage area, 565 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April 17–30	106	7	51.2	1,422	0.090	0.046
May	527	17	190	11,680	.336	.387
June	300	59	169	10,060	.299	.334
July	177	7	61.2	3,763	.108	.124
August	322	47	119	7,317	.211	.243
September	412	31	96.3	5,730	.170	.190
October	381	16	83.1	5,120	.147	.170
December	115	89	105	6,456	.186	.214
The period				51,550		

UNCOMPAHGRE RIVER AT DELTA, COLO.

This station was originally established April 29, 1903, by W. N. Sammis. It was located at a highway bridge one-fourth mile above the Denver and Rio Grande Railroad bridge. The discharge at this point did not include the mill-ditch waste. On November 17, 1903, the station was reestablished at the Denver and Rio Grande Railroad bridge, one-fourth mile northwest from the Denver and Rio Grande Railroad station. The new location was selected for the reason that the discharge of the river at this point includes the mill-ditch waste. This gage consisted of a 2 by 4 inch vertical rod nailed to a 12-inch pile on the downstream side of the railroad bridge. It read from 1 foot to 6 feet. Readings from this gage were taken until April 21, 1904, when an inclined gage was installed on the right bank, 45 feet east of the center of the Denver and Rio Grande Railroad track at the south approach to the bridge. This gage is a 2 by 6 inch rod, graduated by feet and tenths to 6 feet. The bottom of the rod is on the river bottom, and is held in place by six 2 by 4 inch timbers, driven firmly into the bank. Rock is also piled about the bank and around the gage to protect the earth from washing away. One vertical foot equals 1.79 feet on the slope of the rod. There is no definite and constant relation between new and old rods, as cross sections are not identical. Up to November 17, 1903, discharge measurements were made at the highway bridge to which the original gage was attached, or by wading near the gage. After November 17 discharge measurements were

made at Denver and Rio Grande Railroad bridge. Discharge measurements are now made from the road bridge, 100 feet below new gage.

The initial point for soundings is the face of the north abutment at the downstream side of the road bridge, and is marked by a brass-headed nail in the hand rail. During low water discharge measurements are made by wading near the bridge. The channel is straight for about 75 feet above and for 50 feet below the station. The current is sluggish. The right bank is high and clean, and is not subject to overflow. The left bank is low and clean, and might overflow during high water. There is but one channel at all stages. The bed of the stream is composed of earth and fragments of rock, and is fairly permanent. The bench mark for the vertical gage was a cross on the top of the lower chord of the bridge over gage rod. Its elevation was 8.75 feet above the zero of the gage. The bench mark for the inclined gage is a point marked with black paint and the letters "B. M." on the surface of the northeast corner of the stone abutment where the south end of the steel bridge rests, downstream side. Its elevation is 7.36 feet above the zero of the gage. Excluding discharge of seasonal high water in May or June, and an occasional rise from local storms, the water passing this station is entirely seepage water from irrigation above. The observer is Michael O'Rourke.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Uncompahgre River at Delta, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 11	R. I. Meeker	9	4	1.75	[a] 1.85	7
May 2	do	9	2.8	1.32	.65	3.7
May 28	L. E. Foster	22	12	2.17	.9	26
June 9	R. I. Meeker	45	26	.42	.80	11
June 23	L. E. Foster	35	27	.78	.9	21
July 12	R. I. Meeker	25	21	.20	.65	4.2
August 24	L. E. Foster	35	29	.33	.7	9.6
September 17	R. I. Meeker	44	29	.52	.85	15
December 28 [b]	I. W. McConnell	33	57	2.10	1.40	121

[a] Old gage. [b] Velocities by floats, on account of ice.

Mean daily gage height, in feet, of Uncompahgre River at Delta, Colo., for 1904.

Day.	Jan.[a]	Feb.[a]	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.92	3.20	2.18	1.88	0.49	0.89	0.71	0.68	3.15	1.06	1.12	1.49
2	2.92	3.20	2.10	1.88	.55	.88	.70	.69	2.42	.96	1.02	1.54
3	2.98	3.20	2.05	1.89	.61	.70	.69	.69	1.85	.93	1.01	1.53
4	3.10	2.98	2.05	1.88	.59	.69	.67	.69	1.60	.92	1.02	1.58
5	3.05	2.82	2.02	1.84	.66	.67	.66	.70	1.28	.91	1.01	1.61
6	3.05	2.82	2.00	1.82	.62	.63	.65	.69	1.06	1.02	1.00	1.55
7	3.00	2.78	2.00	1.80	.66	.62	.64	.69	1.04	2.25	1.03	1.53
8	3.00	2.75	1.99	1.82	.64	.66	.63	.69	.99	1.29	1.08	1.49
9	2.95	2.70	1.99	1.84	.70	.74	.62	.67	.95	1.34	1.09	1.52
10	3.02	2.75	1.99	1.86	.65	.72	.62	.65	.92	1.39	1.08	1.62
11	3.05	2.75	1.98	1.87	.62	.66	.60	.64	.92	1.32	1.10	1.55
12	3.00	2.85	1.95	1.79	.57	.74	.59	.67	.92	1.33	1.08	1.60
13	3.00	2.75	1.95	1.66	.56	.73	.58	.64	.90	1.33	1.11	1.68
14	3.00	2.80	1.94	1.67	.60	1.22	.56	.63	.86	1.28	1.11	1.62
15	3.22	2.90	1.93	1.67	.66	1.12	.56	.62	.84	1.20	1.42	1.58
16	3.22	2.90	1.94	1.66	.60	.82	.59	.60	.80	1.19	1.59	1.52
17	3.25	2.95	1.89	1.62	.56	.83	.56	.64	.77	1.18	1.44	1.50
18	3.25	2.85	1.85	1.58	.53	.83	.55	.94	.82	1.18	1.39	1.54
19	3.10	2.80	1.83	1.56	.49	.89	.56	1.16	.84	1.18	1.32	1.56
20	2.95	2.75	1.82	1.54	.82	1.30	.56	.92	.84	1.19	1.22	1.59
21	3.02	2.70	1.86	1.49	.56	1.08	.57	.82	.87	1.20	1.17	1.58
22	3.08	2.72	1.84	[b].50	.51	1.02	.57	.78	.97	1.19	1.18	1.68
23	3.18	2.72	1.84	.54	.55	.96	.57	.72	1.04	1.18	1.21	1.65
24	3.08	2.68	1.82	.52	1.42	.89	.57	.70	.95	1.19	1.24	1.61
25	3.05	2.60	1.85	.48	1.50	.86	.56	.70	.90	1.22	1.29	1.60
26	3.05	2.52	1.85	.45	.86	.85	.56	1.31	.88	1.25	1.30	1.54
27	3.15	2.42	1.84	.45	.68	.81	.56	.88	.86	1.20	1.40	1.44
28	3.22	2.30	1.86	.45	.71	.77	.54	.85	.94	1.18	1.44	1.40
29	3.15	2.25	1.89	.48	.66	.73	.74	.90	.96	1.16	1.48	1.40
30	3.25	.....	1.89	.50	.63	.70	.72	1.02	.99	1.19	1.50	[c]1.40
31	3.20	.....	1.88	.....	.86	.....	.68	1.09	.....	1.24	.....	[c]1.40

[a] Gage readings January and February of little value on account of ice condition.
[b] Readings after April 21 at new station.
[c] Ice December 30 and 31.

Rating table for Uncompahgre River at Delta, Colo., from March 1 to April 21, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	1	1.70	3	1.90	10	2.10	22
1.60	2	1.80	6	2.00	15	2.20	30

The above table is applicable only for open-channel conditions. It is based upon 3 discharge measurements made during 1903 and 1904. The table has been extended below gage height 1.85 feet.

Rating table for Uncompahgre River at Delta, Colo., from April 22 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.50	1	0.75	8	1.00	35	1.40	120
.55	2	.80	11	1.10	50	1.50	145
.60	3	.85	15	1.20	70	1.60	170
.65	4	.90	21	1.30	95	1.70	195
.70	6	.95	27				

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is well defined between gage heights 0.65 foot and 1.40 feet. The table has been extended beyond these limits. Estimates above gage height 1.70 feet made on the basis that the rating curve is a tangent, the difference being 25 per tenth.

Estimated monthly discharge of Uncompahgre River at Delta, Colo., for 1904.

[Drainage area, 1,130 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March	28	7	12.0	738	0.011	0.013
April	10	1	4.2	250	.0037	.0041
May	145	1	12.7	781	.011	.013
June	95	3	19.4	1,154	.017	.019
July	8	2	3.4	209	.0030	.0035
August	98	3	15.3	941	.014	.016
September	557	9	67.0	3,987	.059	.066
October	332	22	77.5	4,765	.069	.080
November	168	35	78.0	4,641	.069	.077
December	190	120	156	9,592	.138	.159
The period				27,060		

SAN JUAN RIVER NEAR FARMINGTON, N. MEX.

This station was established June 18, 1904, by M. C. Hinderlider. It is located at the suspension footbridge at the Methodist Indian school, about 3 miles south of Farmington, N. Mex., and about 2 miles below the mouth of Animas River. A standard wire gage is attached to a framework extending from the top of a sandstone cliff, about 15 feet above low water, on the right bank of the river 300 yards above the bridge. The gage scale is placed horizontally on

the top of the cliff and is graduated to feet and tenths from zero to 20 feet. The length of the wire from the end of the weight to the marker is 20.29 feet. Discharge measurements are made from the suspension footbridge. The bridge is 345 feet long and marked on the floor every 5 feet with black paint. The initial point for soundings is the south face of the main bridge support on the right bank of the river marked "0 initial point" with black paint. The channel is straight for about 900 feet above and below the station. The current is swift at high, and medium at low, stages. The right bank is a high sandstone cliff and can not overflow. The left bank at low water is a gravel bar extending out to 325 feet from the initial point for soundings, when it rises to a height of 6 feet. It probably never overflows beyond this point. The bed of the stream is composed of cobblestones, shale, and a few scattering large bowlders. It is clean and permanent. There is but one channel at all stages. The bench mark is a cross painted black on the top of the sandstone cliff, about 50 feet east of the gage. It is marked "U. S. G. S. B. M." Its elevation is 12.79 feet above the gage datum. The top of the gage rod (above the brace) is 0.825 foot above the bench mark. The marker is a knot tied in the wire near the ring.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of San Juan River near Farmington, N. Mex., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 19	M. C. Hinderlider	248	431	3.40	4.40	1,465
July 2	R. C. Prewitt	244	314	2.18	3.83	684
July 9	do	237	224	1.60	3.36	359
July 18	do	38	37	1.65	2.80	61
July 27	do	235	241	1.82	3.59	438
August 3	do	250	539	4.49	4.95	2,421
August 19	do	255	582	5.55	5.30	3,231
August 22	do	247	405	3.11	4.65	1,259
September 3	do	252	514	4.93	5.00	2,533
September 10	do	245	345	3.23	4.39	1,116
September 20	do	238	241	2.15	4.15	518
September 30	do	255	580	6.02	5.50	3,494
October 13	do	285	809	5.89	6.00	4,767

NOTE.—See page 228 for other measurements of San Juan River.

Mean daily gage height, in feet, of San Juan River near Farmington, N. Mex., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.85	4.72	5.45	7.65	4.60	3.90
2	.....	3.75	4.85	5.48	6.65	4.55	3.85
3	.....	3.70	5.10	5.10	5.90	4.60	3.90
4	.....	3.70	4.80	4.85	5.20	4.60	3.70
5	.....	3.65	5.55	4.35	5.15	4.50	3.35
6	.....	3.60	5.30	4.35	5.35	4.50	3.13
7	.....	3.55	4.65	4.60	6.85	4.45	3.25
8	.....	3.35	5.25	4.58	[a] 8.60	4.60	3.00
9	.....	3.32	5.65	4.55	[b] 12.00	4.53	3.05
10	.....	3.32	5.50	4.48	[b] 9.00	4.45	3.50
11	.....	3.20	5.30	4.15	[b] 8.00	4.43	2.90
12	.....	3.02	4.95	4.15	[b] 7.00	4.55	2.95
13	.....	2.92	4.95	4.20	6.55	4.35	3.00
14	.....	2.82	4.95	4.25	6.60	4.20	3.10
15	.....	2.70	4.95	4.20	6.60	4.10	3.20
16	.....	2.65	5.00	4.18	6.50	4.15	3.35
17	.....	2.65	5.05	4.22	6.30	4.00	3.30
18	.....	2.70	6.10	4.25	6.20	4.10	3.38
19	4.30	2.68	5.70	4.22	6.15	4.20	3.35
20	4.25	2.65	5.60	4.05	5.90	3.95	3.40
21	4.25	2.65	5.10	4.15	5.80	4.00	3.32
22	4.15	2.62	4.65	4.05	5.90	3.75	3.38
23	4.20	2.60	4.68	4.25	5.80	3.90	3.35
24	4.15	2.65	4.68	4.60	5.85	3.80	3.28
25	4.05	3.55	5.10	4.35	5.85	3.90	3.35
26	4.15	4.10	4.82	4.35	5.80	3.85	3.32
27	3.90	3.65	4.88	4.50	5.80	3.90	3.72
28	3.95	3.52	4.85	4.70	5.55	3.90	3.75
29	3.95	3.55	4.78	4.65	5.45	3.95	3.62
30	3.90	4.48	4.85	7.55	5.35	3.90	3.22
31	.....	4.35	5.80	.....	5.20	.....	3.20

[a] Gage washed away October 8; reestablished October 13.
[b] Gage heights estimated October 9 to 12.

Rating table for San Juan River near Farmington, N. Mex., from June 19 to August 18, 1904, and from November 9 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.60	20	3.20	230	4.20	1,150	5.20	2,970
2.65	27	3.30	290	4.30	1,300	5.30	3,190
2.70	35	3.40	350	4.40	1,450	5.40	3,410
2.75	45	3.50	420	4.50	1,610	5.50	3,630
2.80	55	3.60	500	4.60	1,780	5.60	3,850
2.85	70	3.70	580	4.70	1,950	5.70	4,070
2.90	90	3.80	680	4.80	2,140	5.80	4,290
2.95	110	3.90	780	4.90	2,340	5.90	4,520
3.00	130	4.00	900	5.00	2,540	6.00	4,750
3.10	180	4.10	1,020	5.10	2,750	6.10	4,980

The above table is based upon 9 discharge measurements made during 1904. It is well defined between gage heights 2.70 feet and 6.00 feet.

Rating table for San Juan River near Farmington, N. Mex., from August 19 to November 8, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.00	350	4.80	1,775	6.10	5,000	7.40	8,250
4.05	400	4.90	2,000	6.20	5,250	7.50	8,500
4.10	450	5.00	2,250	6.30	5,500	7.60	8,750
4.15	525	5.10	2,500	6.40	5,750	7.70	9,000
4.20	600	5.20	2,750	6.50	6,000	7.80	9,250
4.25	680	5.30	3,000	6.60	6,250	7.90	9,500
4.30	770	5.40	3,250	6.70	6,500	8.00	9,750
4.35	860	5.50	3,500	6.80	6,750	8.10	10,000
4.40	950	5.60	3,750	6.90	7,000	8.20	10,250
4.45	1,050	5.70	4,000	7.00	7,250	8.40	10,750
4.50	1,150	5.80	4,250	7.10	7,500	8.60	11,250
4.60	1,350	5.90	4,500	7.20	7,750	8.80	11,750
4.70	1,550	6.00	4,750	7.30	8,000	9.00	12,500

The above table is based upon 5 discharge measurements made during 1904. It is poorly defined. The table has been extended above gage height 6 feet. Above gage height 5 feet the rating curve is a tangent, the difference being 250 per tenth.

Estimated monthly discharge of San Juan River near Farmington, N. Mex., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June 19–30	1,300	780	1,030	24,520
July	1,578	20	375	23,060
August	4,980	1,450	2,627	161,500
September	8,625	400	1,375	81,820
October	20,000	2,625	5,935	364,900
November	1,695	630	1,087	64,680
December	780	90	348	21,400
The period				741,900

ANIMAS RIVER AT DURANGO, COLO.

The station was first established June 20, 1895, and has been maintained during the greater part of each year since.

The original gage was located at the old wagon bridge, one-fourth mile west of the railroad bridge at Durango and about 200 feet above the Rio Grande Southern Railroad bridge. It was spiked to the west

side of the south end of the middle pier of the wagon bridge. The head of a bolt at the east abutment of the railroad bridge is 17.24 feet above this gage datum. During the early part of 1899 the old wagon bridge was removed and a new one erected a short distance below. April 1, 1899, on the central pier of this bridge a new rod, which consisted of a vertical piece of timber graduated to feet and tenths, was fastened. The bench marks were three horizontal strips, opposite the 10, 14, and 16.7 foot marks of the rod, respectively. Owing to this change in location and height of the rod there is no apparent relation between the rating tables before 1899 and the rating tables for 1899 and after.

The present gage was established June 20, 1901, by A. P. Davis. It is located at the new wagon bridge, one-fourth mile west of the railroad station at Durango, Colo. It is a vertical 2 by 6 inch timber 14 feet long. It is fastened to the masonry pier on the downstream side of the bridge, and is held in place by means of spikes driven into cracks in the masonry. It is read twice each day by C. G. Graden. On April 1–2, 1903, sand and gravel were washed down by Lightner Creek, which enters about 100 feet below the bridge, and were deposited around the gage rod. A new wire gage was established April 14, 1903, on the downstream side of the bridge in the span next the left bank. This gage was read until June 6, when it was stolen. In the meantime the sand and gravel had been washed away from the foot of the old gage, from which readings were taken for the remainder of the year. The wire gage read zero when the vertical gage read 5 feet. All 1903 readings have been reduced to the datum of the vertical gage. The 1903 rating table was prepared from measurements made after the deposit of sand and gravel had been scoured from around the vertical gage. It is therefore not applicable to gage heights taken previous to May 1, during which period the section at the gage was filled in. Discharge measurements are made from the bridge to which the gage is attached, except at low water, when they are made by wading. The initial point for soundings is the downstream edge of the right abutment. The channel is straight for 300 feet above, and 400 feet below, the station. The current is rough and has a rapid velocity. Both banks are high, rocky, and not liable to overflow. The bed of the stream is rocky and fairly permanent. Bench mark No. 1, established June 25, 1900, is a chiseled point at the southwest corner of the center pier of the highway bridge. Its elevation is 16.75 feet above the zero of the gage. Bench mark No. 2, established on the same date, is a similar point on the lower side of the left abutment. Its elevation is 16.84 feet above the zero of the gage. This relation was verified April 17, 1901.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Animas River at Durango, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 12	G. B. Monk	150	196	1.96	7.15	384
August 20	R. I. Meeker	150	256	2.97	7.60	760

Mean daily gage height, in feet, of Animas River at Durango, Colo., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	7.70	8.20	8.60	7.60	7.10
2	.....	7.80	8.20	8.20	7.60	7.10
3	.....	7.80	8.20	8.00	7.60	7.10
4	.....	7.80	8.00	7.90	7.50	7.10
5	.....	7.60	7.90	7.60	7.50	7.10
6	.....	7.60	7.70	8.45	7.50	7.10
7	7.30	7.50	7.70	9.20	7.50	7.10
8	7.30	7.60	7.50	9.60	7.50	7.10
9	7.30	7.60	7.40	10.00	7.40	7.10
10	7.30	7.50	7.40	9.80	7.30	7.10
11	7.30	7.90	7.40	9.80	7.30	7.00
12	7.20	7.70	7.40	9.60	7.30	7.00
13	7.20	7.80	7.30	9.60	7.20	7.00
14	7.20	7.90	7.40	9.20	7.20	7.00
15	7.20	7.80	7.30	8.70	7.20	7.00
16	7.10	7.70	7.30	8.40	7.20	7.00
17	7.20	7.60	7.30	8.20	7.20	7.00
18	7.20	7.60	7.30	8.20	7.20	.....
19	7.00	7.70	7.30	8.10	7.20	.....
20	7.00	7.70	7.20	8.00	7.20	.....
21	7.00	7.60	7.20	8.00	7.20	.....
22	7.00	7.50	7.20	8.00	7.20	.....
23	7.20	7.40	7.40	8.00	7.20	.....
24	7.30	7.80	7.50	7.90	7.20	.....
25	7.30	7.70	7.50	7.90	7.10	.....
26	7.30	7.60	7.50	7.80	7.20	.....
27	7.30	8.00	7.40	7.70	7.20	.....
28	7.20	8.10	7.40	7.70	7.20	.....
29	7.20	8.00	7.55	7.70	7.20	.....
30	7.50	8.10	8.40	7.60	7.10	.....
31	7.50	8.20	.....	7.60	.....	.....

Rating table for Animas River at Durango, Colo., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.50	122	7.10	362	8.10	1,285	9.10	2,420
6.55	136	7.20	429	8.20	1,395	9.20	2,550
6.60	150	7.30	504	8.30	1,505	9.30	2,680
6.65	164	7.40	586	8.40	1,615	9.40	2,810
6.70	179	7.50	672	8.50	1,725	9.50	2,940
6.75	195	7.60	761	8.60	1,835	9.60	3,070
6.80	213	7.70	854	8.70	1,950	9.70	3,210
6.85	234	7.80	955	8.80	2,065	9.80	3,350
6.90	257	7.90	1,065	8.90	2,180	9.90	3,490
6.95	281	8.00	1,175	9.00	2,300	10.00	3,630
7.00	306						

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 2 measurements made in 1904. It is well defined between gage heights 6.75 feet and 8.10 feet. The table has been extended below gage height 6.75.

Estimated monthly discharge of Animas River at Durango, Colo., for 1904.

[Drainage area, 812 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
July 7–31	672	306	453	22,460	0.558	0.514
August	1,395	586	903	55,520	1.11	1.28
September	1,615	429	738	43,910	.909	1.10
October	3,630	761	1,679	103,200	2.07	2.39
November	761	362	511	30,410	.629	.702
December 1–17	362	306	339	11,430	.417	.264
The period				266,900		

ANIMAS RIVER AT AZTEC, N. MEX.

This station was established June 21, 1904, by M. C. Hinderlider. It is located at the wagon bridge about three-eighths of a mile west of Aztec, N. Mex. A plain staff gage, graduated to feet and tenths from 2 to 10 feet, is spiked vertically to the downstream side of the north face of the pile bent under the right or south end of the main bridge truss, the 2-foot mark resting on the river bed. It is read twice each day by G. A. Black. Discharge measurements are made at high water from the downstream side of the wooden truss bridge, consisting of one truss 110 feet long, reached by approaches at either end resting on pile bents. The bridge floor is marked with black paint at each 5 feet from zero to 195 feet. The initial point for soundings is the head of a large nail in the top of the floor of the east approach, on the downstream side of the bridge, marked with black paint zero. At extremely low water measurements may be made by wading above or below the bridge.

The channel is straight for 600 feet above and 1,000 feet below the station, and the current is moderate. The right bank is a gradually sloping loam and gravel bank, rising about 4 feet above low water. It is covered with cottonwood trees and brush, and rarely overflows. The left bank rises abruptly from the water about 5 feet and does not overflow. The bed of the stream is composed of cobblestones and a light deposit of silt. It is free from vegetation, uniform, and fairly permanent. There is one channel at all stages, broken by a crib pier near the south side of the stream, and also four sets of piles under the south end of the bridge. The river forks about 100 feet above the bridge, there being an island at high stages. The bench mark is a 20-penny nail driven into the northeast root of a 30-inch cottonwood tree standing about 100 feet southwest of the end of the bridge on the right bank. Its elevation is 7.14 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Animas River at Aztec, N. Mex., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 20	M. C. Hinderlider	116	342	2.60	4.67	889
July 7	R. C. Prewitt	102	227	1.36	3.89	309
July 10	do	101	205	1.28	3.69	262
July 17	do	101	192	.94	3.52	181
July 24	do	101	172	.80	3.39	137
August 2	do	109	232	2.37	4.31	550
August 16	do	140	285	2.94	5.38	839
August 25	do	130	283	3.30	5.23	933
September 5	do	121	258	2.83	4.80	728
September 9	do	112	188	2.59	4.38	488
September 19	do	112	149	1.83	4.00	273
September 24	do	115	231	2.32	4.61	536
October 1	do	145	378	5.05	5.30	1,910
October 14	do	105	408	3.92	5.04	1,600
October 21	do	105	242	2.96	4.87	716
October 28	do	102	212	2.08	4.68	442
November 6	do	97	170	2.01	4.40	342
November 13	do	98	132	1.84	4.28	241
November 19	do	64	122	2.57	4.30	314
November 26	do	62	92	1.67	4.15	154
December 2	do	62	92	1.77	4.15	164
December 13	do	63	100	1.76	4.20	176

Mean daily gage height, in feet, of Animas River at Aztec, N. Mex., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.15	4.60	5.35	5.25	4.50	4.10
2	.....	4.15	4.35	5.20	4.95	4.55	4.10
3	.....	4.00	4.49	5.12	5.12	4.60	4.10
4	.....	4.00	4.60	5.00	5.52	4.52	4.25
5	.....	3.95	4.55	4.92	5.85	4.50	4.25
6	.....	3.92	4.42	4.85	7.50	4.45	4.20
7	.....	3.90	5.75	4.90	6.08	4.42	4.20
8	.....	3.80	4.98	4.75	7.40	4.38	4.20
9	.....	3.72	5.10	4.60	5.85	4.32	4.20
10	.....	3.68	5.05	4.48	7.40	4.30	4.20
11	.....	3.62	5.50	4.38	5.68	4.30	.....
12	.....	3.60	5.45	4.20	5.00	4.30	.....
13	.....	3.55	5.75	4.18	5.05	4.30	.....
14	.....	3.50	5.60	4.12	5.02	4.30	.....
15	.....	3.44	5.50	4.15	5.12	4.30	.....
16	.....	3.42	5.40	4.20	5.05	4.30	.....
17	.....	3.49	5.35	4.00	4.95	4.28	.....
18	.....	3.54	5.42	4.12	4.90	4.28	.....
19	.....	3.42	5.30	4.20	4.85	4.22	.....
20	.....	3.40	5.25	4.28	4.78	4.18	.....
21	4.60	3.38	5.08	4.45	4.88	4.25	.....
22	4.55	3.38	4.95	4.50	4.75	4.22	.....
23	4.60	3.34	5.02	4.85	4.85	4.28	.....
24	4.45	3.40	5.10	4.90	4.75	4.25	.....
25	4.45	3.60	5.15	4.72	4.72	4.28	.....
26	4.35	3.53	5.25	4.65	4.65	4.24	.....
27	4.25	3.48	5.05	4.80	4.62	4.20	.....
28	4.25	5.49	5.15	4.82	4.55	4.18	.....
29	4.20	3.56	5.25	4.95	4.58	4.10	.....
30	4.15	4.15	5.38	5.18	4.50	4.10	.....
31	.....	4.10	5.25	.....	4.48	.....	.....

Rating table for Animas River at Aztec, N. Mex., from June 19 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.30	120	3.80	255	4.60	640	5.60	1,860
3.35	130	3.85	270	4.70	720	5.70	2,020
3.40	140	3.90	290	4.80	810	5.80	2,180
3.45	152	3.95	310	4.90	910	5.90	2,340
3.50	166	4.00	330	5.00	1,020	6.00	2,500
3.55	180	4.10	370	5.10	1,140	6.10	2,660
3.60	195	4.20	410	5.20	1,270	6.20	2,820
3.65	210	4.30	460	5.30	1,400	6.30	2,980
3.70	225	4.40	510	5.40	1,540	6.40	3,140
3.75	240	4.50	570	5.50	1,700	6.50	3,300

The above table is based upon 22 discharge measurements made during 1904. Above gage height 5.40 feet the rating curve is a tangent, the difference being 160 per tenth. Owing to the shifting character of the stream bed this table was applied indirectly, according to the method outlined in the Nineteenth Annual Report, United States Geological Survey, Part IV, page 323 et seq.

Mean daily discharge, in feet, of Animas River at Aztec, N. Mex., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	410	765	1,270	1,860	390	152
2	.....	410	570	1,080	1,400	410	152
3	.....	350	640	1,020	1,620	435	152
4	.....	350	680	910	2,260	390	195
5	.....	310	605	810	2,900	390	195
6	.....	290	510	810	5,540	370	180
7	.....	290	1,940	860	3,300	350	180
8	.....	270	860	720	5,380	330	180
9	.....	255	910	640	2,980	290	166
10	.....	255	810	540	5,460	270	166
11	.....	225	1,270	485	2,740	270	166
12	.....	225	1,140	390	1,620	270	195
13	.....	195	1,470	390	1,780	255	166
14	.....	180	1,205	330	1,700	270	195
15	.....	168	1,020	350	1,780	270	.....
16	.....	152	860	370	1,540	290	.....
17	.....	166	860	290	1,270	290	.....
18	.....	180	910	310	1,080	310	.....
19	.....	140	860	350	910	270	.....
20	.....	140	810	390	720	255	.....
21	810	140	720	460	720	255	.....
22	765	140	605	485	605	225	.....
23	765	130	680	720	640	240	.....
24	640	140	765	765	540	210	.....
25	640	195	860	640	510	210	.....
26	570	180	965	680	460	570	.....
27	485	180	810	860	435	570	.....
28	485	180	910	910	390	570	.....
29	460	210	1,080	1,205	410	152	.....
30	435	435	1,270	1,620	370	152	.....
31	.....	410	1,080	.....	390	.....	.....

Estimated monthly discharge of Animas River at Aztec, N. Mex., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June 21–30	810	435	606	12,020
July	435	130	235	14,450
August	1,940	510	917	56,380
September	1,620	290	689	41,000
October	5,540	370	1,720	105,800
November	570	152	318	18,920
December 1–14	195	152	174	4,830
The period				253,400

ANIMAS RIVER NEAR FARMINGTON, N. MEX.

This station was established June 18, 1904, by M. C. Hinderlider. It is located at the highway bridge about 1 mile northeast of Farmington, N. Mex. A standard chain gage is attached to the downstream side of the bridge, 40 feet from the left end of the bridge. The gage scale is graduated to feet and tenths from 2 feet to 7.8 feet. The length of the chain from the end of the weight to the marker is 12.78 feet. The gage is read twice each day by Mrs. Adellie Ricketts, who lives near the west end of the bridge. Discharge measurements are made from the downstream side of the two-span bridge to which the gage is attached. The initial point for soundings is the west face of the left abutment. It is marked "O" with black paint on the bridge floor, and the sounding points are similarly marked every 5 feet up to 195 feet. The channel is straight for about 900 feet above and below the station, and the current is moderate to swift. The right bank is a gradually sloping gravel bar, covered with small cobblestones and scattering trees and shrubs. It has been known to overflow, but this is an extremely rare occurrence. The left bank is a flat, grassy, perpendicular bank, 5 or 6 feet above low water, lined with willows, and is not subject to overflow. The bed of the stream is composed of gravel, cobblestones, and silt. It is free from vegetation and is permanent. The bench mark is a United States Geological Survey standard bench-mark tablet set into the southwest face of a 12-inch cottonwood tree about 50 feet north of the right end of the bridge. Its elevation is 11.13 feet above the datum of the gage and 3.17 feet below the top of the horizontal bridge chord on which the gage box rests.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of Animas River near Farmington, N. Mex.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 17	M. C. Hinderlider	132	321	2.39	5.49	765
July 2	R. C. Prewitt	117	200	1.50	4.82	299
July 9	do	109	155	.95	4.51	147
July 18	do	99	115	.38	4.17	43
July 27	do	100	120	.51	4.22	61
August 5	do	120	287	2.14	5.31	614
August 13	do	125	321	2.55	5.48	818
August 20	do	122	270	2.43	5.39	657
August 24	do	118	222	2.08	5.12	461
September 6	do	121	222	2.23	5.20	495
September 12	do	116	152	1.61	4.78	244
September 21	do	106	125	1.43	4.57	179
September 28	do	123	207	2.18	5.20	451
October 7	do	141	466	4.37	6.34	2,035
October 15	do	132	365	3.33	5.90	1,215
October 20	do	127	270	2.63	5.44	711
October 29	do	132	216	2.31	5.05	498
November 4	do	121	189	2.01	4.91	380
November 17	do	120	136	1.73	4.57	235
November 28	do	80	102	1.42	4.35	144
December 5	do	81	108	1.47	4.38	159
December 12	do	81	106	1.45	4.34	154
December 22	do	80	95	1.38	4.24	131

Mean daily gage height, in feet, of Animas River near Farmington, N. Mex., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.92	5.20	5.76	6.30	4.98	4.32
2	.....	4.82	5.16	5.84	6.08	4.94	4.32
3	.....	4.74	5.26	5.65	5.92	4.90	4.36
4	.....	4.72	5.34	5.46	5.82	4.86	4.46
5	.....	4.70	5.34	5.35	5.69	4.83	4.38
6	.....	4.64	5.16	5.23	5.72	4.80	4.32
7	.....	4.62	5.46	5.12	7.58	4.74	4.29
8	.....	4.50	5.23	5.04	7.44	4.73	4.26
9	.....	4.48	5.52	4.98	6.96	4.69	4.29
10	.....	4.48	5.34	4.90	6.48	4.68	4.31
11	.....	4.49	5.36	4.84	6.28	4.66	4.28
12	.....	4.32	5.60	4.74	6.14	4.59	4.32
13	.....	4.18	5.50	4.64	6.15	4.52	4.36
14	.....	4.06	5.54	4.69	6.00	4.56	4.31
15	.....	3.99	5.56	4.76	5.88	4.55	4.31
16	.....	3.95	5.51	4.62	5.85	4.54	4.36
17	.....	3.90	5.35	4.60	5.78	4.50	4.34
18	.....	4.14	5.65	4.58	5.66	4.50	4.34
19	.....	3.97	5.62	4.56	5.55	4.48	4.31
20	5.46	3.88	5.44	4.52	5.46	4.44	4.33
21	5.60	3.88	5.28	4.62	5.42	4.44	4.34
22	5.50	3.79	5.13	4.60	5.40	4.40	4.36
23	5.51	3.79	5.28	4.68	5.36	4.36	4.28
24	5.40	3.88	5.25	4.88	5.32	4.36	4.25
25	5.35	4.36	5.50	5.14	5.27	4.36	4.21
26	5.22	4.23	5.32	5.12	5.22	4.34	4.28
27	5.10	4.18	5.40	5.22	5.16	4.35	4.36
28	5.05	4.18	5.46	5.21	5.12	4.34	4.24
29	5.01	4.32	5.41	5.21	5.08	4.34	4.24
30	4.96	4.86	5.50	5.41	5.03	4.34	4.56
31	.....	5.12	5.88	.....	5.02	.....	4.47

Rating table for Animas River near Farmington, N. Mex., from June 20 to October 19, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.80	4	4.40	107	5.50	775	6.60	2,410
3.85	5	4.45	122	5.60	885	6.70	2,590
3.90	7	4.50	137	5.70	1,000	6.80	2,770
3.95	11	4.60	173	5.80	1,125	6.90	2,950
4.00	17	4.70	211	5.90	1,250	7.00	3,130
4.05	25	4.80	253	6.00	1,390	7.10	3,310
4.10	35	4.90	300	6.10	1,545	7.20	3,490
4.15	46	5.00	353	6.20	1,710	7.30	3,670
4.20	58	5.10	415	6.30	1,880	7.40	3,850
4.25	70	5.20	488	6.40	2,050	7.50	4,030
4.30	82	5.30	573	6.50	2,230	7.60	4,210
4.35	94	5.40	670				

The above table is based upon discharge measurements made prior to October 25, 1904. It is fairly well defined between gage heights 4.20 feet and 6.00 feet. The table has been extended beyond these limits. Above gage height 6.40 feet the rating curve is a tangent, the difference being 180 per tenth.

Rating table for Animas River near Farmington, N. Mex., from October 20 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.20	125	4.50	208	4.80	337	5.10	510
4.25	137	4.55	225	4.85	363	5.20	580
4.30	150	4.60	243	4.90	390	5.30	655
4.35	163	4.65	263	4.95	420	5.40	735
4.40	177	4.70	287	5.00	450	5.50	825
4.45	192	4.75	311				

The above table is based upon 7 discharge measurements made after October 25, 1904. It is well defined.

Estimated monthly discharge of Animas River near Farmington, N. Mex., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June 20–30	885	332	588	12,830
July	430	4	112	6,888
August	1,225	437	687	42,240
September	1,175	144	414	24,640
October	4,174	462	1,301	80,000
November	438	160	245	14,580
December	229	127	158	9,715
The period				190,900

LA PLATA RIVER AT HESPERUS, COLO.

This station was established June 14, 1904, by M. C. Hinderlider, for the purpose of determining the water supply in La Plata River available for the La Plata project in New Mexico. It is located at the highway bridge on the west side of Hesperus, Colo. The gage consists of a 1 by 4 inch dressed-pine board 4 feet long, graduated to feet and tenths. The gage reads from zero to 3.9 feet, the zero resting on the bed of the river. The gage is spiked to the upstream end of the south face of the north abutment and is read twice each day by Hans Aspaas. Discharge measurements are made by wading at suitable points along the stream, as the conditions for careful gagings at the bridge are unfavorable. The initial point for soundings is a nail driven into the downstream side of the wagon bridge over the south face of the north abutment. The channel is straight for about 50 feet above and below the station, and the current is swift. Both banks are low, covered with brush and scattering trees, and are not subject to overflow. The bed of the stream is composed of large and small cobblestones and is permanent. There is a small island above the bridge and dead water at low stage and tortuous channel below the bridge, which would affect the accuracy of meter measurements at the bridge. The fall in La Plata River, according to levels run by the La Plata Ditch Company for about 10 miles, is 135 feet per mile. The bench mark is a nail, about 8 inches above the ground, on the right bank of the river, driven horizontally into the west face of a 12-inch cottonwood tree and about 75 feet northeast of the gage rod. Its elevation is 9.15 feet above the zero of the gage. This station was abandoned August 12, 1904.

The observations at this station during 1904 have been made under the direction of M. C. Hinderlider, district hydrographer.

Discharge measurements of La Plata River at Hesperus, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 14	M. C. Hinderlider	24	20	0.90	1.98	18
July 12	G. B. Monk	22	17	.47	1.90	8
August 20	R. I. Meeker	24	26	1.50	2.30	39

Mean daily gage height, in feet, of La Plata River at Hesperus, Colo., for 1904.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	.....	1.88	2.38	12	.....	1.82	.....	22	1.92	1.82	.....
2	.....	1.88	2.42	13	.....	1.82	.....	23	1.85	1.80	.....
3	.....	1.88	2.32	14	.....	1.82	.....	24	1.82	1.85	.....
4	.....	1.90	2.25	15	1.94	1.82	.....	25	1.88	1.88	.....
5	.....	1.85	2.20	16	1.94	1.82	.....	26	1.85	1.88	.....
6	.....	1.88	2.20	17	1.96	1.78	.....	27	1.85	1.88	.....
7	.....	1.85	.....	18	1.90	1.80	.....	28	1.85	1.92	.....
8	.....	1.90	.....	19	1.85	1.80	.....	29	1.82	1.92	.....
9	.....	1.82	.....	20	1.85	1.82	.....	30	1.88	1.92	.....
10	.....	1.80	2.25	21	1.85	1.82	.....	31	.....	2.32	.....
11	.....	1.82	2.20								

MUDDY RIVER NEAR MOAPA, NEV.

This station was established January 1, 1904, by A. E. Chandler. It is located near the crossing of the San Pedro, Los Angeles and Salt Lake Railroad, about 6 miles downstream from Moapa, Nev. The station is above the Narrows, and will show the amount of water available for storage at the proposed reservoir sites in the Narrows. A vertical plain staff gage, graduated to feet and tenths, is nailed to a post driven into the right bank. It is read twice each day by J. V. Houghton. Discharge measurements are made from a footbridge 450 feet downstream from the gage. The initial point for soundings is a nail driven into the downstream side of the bridge at the right bank. The channel is straight for 35 feet above and below the station, and the velocity is moderate. The immediate banks are low, but not liable to overflow. High brush-covered banks slope up from the vertical sides of the channel. The bed of the stream is composed of sand and is shifting. It is covered with vegetation, which is kept grubbed out near the station. The bench mark is the top of a 2-inch circular post driven into the ground in a willow clump 20 feet from the gage on the right bank. Its elevation is 9.90 feet below the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Muddy River near Moapa, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 12	A. E. Chandler	11	34	1.24	2.10	42
June 11	H. H. Church	11	25	1.46	1.70	36
July 16	do	11	20	1.63	1.40	33
August 1	do	11	23	1.72	1.80	40
August 13	do	12	28	1.75	2.20	49
August 19	do	12	40	1.82	3.50	73
September 21	do	11	29	1.55	1.80	44
October 15	do	11	26	1.47	1.70	38
November 10	do	11	28	1.43	1.90	40
December 12	do	12	29	1.70	2.10	49

Mean daily gage height, in feet, of Muddy River near Moapa, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.20	2.98	2.60	2.48	2.02	2.02	1.60	1.90	1.80	1.80	1.90	2.00
2	3.20	2.98	2.60	2.48	2.02	2.02	1.60	1.70	1.80	1.80	1.90	2.00
3	3.20	2.98	2.60	2.48	2.02	2.02	1.70	1.85	1.80	1.80	1.90	2.00
4	3.18	3.00	2.60	2.48	2.02	2.02	1.65	1.70	1.80	1.80	1.90	2.00
5	3.15	2.98	2.60	2.48	2.02	2.02	1.60	1.70	1.80	1.70	1.90	2.00
6	3.15	2.98	2.60	2.48	2.02	2.02	1.65	1.70	1.80	1.60	1.90	2.00
7	3.15	2.98	2.60	2.48	2.02	2.02	1.60	1.70	1.80	1.60	1.90	2.00
8	3.15	2.98	2.60	2.48	2.02	2.02	1.60	1.70	1.80	1.60	1.90	2.00
9	3.10	2.98	2.50	2.48	2.02	2.02	1.55	1.70	1.80	1.60	1.90	2.00
10	3.10	2.98	2.50	2.48	2.02	2.02	1.50	2.00	1.80	1.60	1.90	2.00
11	3.10	2.98	2.50	2.48	2.02	2.02	1.50	3.50	1.80	1.60	1.90	2.10
12	3.10	2.98	2.50	2.48	2.02	1.80	1.50	4.00	2.65	1.60	1.90	2.10
13	3.10	2.95	2.50	2.48	2.02	1.80	1.50	2.22	9.50	1.60	1.90	2.10
14	3.10	2.95	2.50	2.25	2.02	1.80	1.50	2.20	6.50	1.60	1.90	2.10
15	3.05	2.90	2.50	2.25	2.02	1.80	1.50	2.25	3.00	1.60	1.90	2.10
16	3.05	2.90	2.50	2.25	2.02	1.80	1.50	2.30	1.80	1.60	1.90	2.10
17	3.10	2.80	2.48	2.25	2.02	1.80	1.50	2.40	1.80	1.60	1.90	2.10
18	3.10	2.80	2.48	2.25	2.02	1.80	1.50	3.00	1.80	1.60	1.90	2.10
19	3.10	2.80	2.48	2.02	2.02	1.80	1.60	4.25	1.80	1.60	1.90	2.20
20	3.10	2.80	2.48	2.02	2.02	1.80	1.60	5.00	1.80	1.60	1.90	2.20
21	3.08	2.68	2.48	2.02	2.02	1.80	1.60	1.80	1.80	1.60	1.90	2.20
22	3.05	2.68	2.48	2.02	2.02	1.80	1.75	2.25	1.80	1.60	1.90	2.20
23	3.08	2.68	2.48	2.02	2.02	1.80	1.65	2.75	1.80	1.60	2.00	2.20
24	3.08	2.62	2.48	2.02	2.02	1.80	1.80	3.00	1.80	1.60	2.00	2.20
25	3.05	2.60	2.48	2.02	2.02	1.80	1.80	5.00	1.80	1.60	2.00	2.20
26	3.05	2.60	2.48	2.02	2.02	1.80	1.80	2.50	1.80	1.60	2.00	2.20
27	3.02	2.60	2.48	2.02	2.02	1.80	1.85	2.50	1.80	1.80	2.00	2.20
28	3.02	2.60	2.48	2.02	2.02	1.80	1.90	3.50	1.80	1.80	2.00	2.20
29	3.02	2.60	2.48	2.02	2.02	1.80	1.95	2.00	1.80	1.90	2.00	2.20
30	3.00	.....	2.48	2.02	2.02	1.80	1.90	2.00	1.80	1.90	2.00	2.20
31	3.00	.....	2.48	.....	2.02	.....	2.50	1.80	.....	1.90	.....	2.20

GILA RIVER NEAR CLIFF, N. MEX.

This station was established September 9, 1904, by W. A. Farish. It is located one-half mile below the mouth of Mangos River and 40 miles from Silver City, N. Mex. The station is best reached by stage from Silver City to Gila Store, thence by private conveyance to the station. If the river is in flood, the latter part of the journey will have to be made horseback. A staff gage is fastened to a large cottonwood tree on the east side of the river. The gage is read twice each day by Mrs. Winnie P. Clark. Discharge measurements are made by means of a five-eighths-inch cable and car. The station is equipped with a tagged wire, marked every 5 feet. The initial point for soundings is the zero of the tagged wire. The channel is straight for 400 feet above and 300 feet below the station. The current is swift. Both banks are about 6 feet high, clean, and subject to overflow during extreme high water. The bed of the stream is composed of sand and gravel, free from vegetation, and shifting. There is but one channel at high and low stages. The channel, although straight, cuts across the section at a slight angle during low water. During freshets the channel will be at right angles to the measuring section. The bench mark is a point marked "U. S. G. S. B. M." with black paint in a blaze on a sycamore tree north 84 east 293 feet from the gage. Its elevation is 8.55 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of C. G. Williams, district hydrographer.

Mean daily gage height, in feet, of Gila River near Cliff, N. Mex., for 1904.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	2.32	0.87	1.10	17	1.90	1.00	1.10	1.05
2	.....	2.31	.90	1.10	18	1.82	1.00	1.10	1.00
3	.....	2.97	.90	1.16	19	1.79	1.00	1.10	1.00
4	.....	2.60	.92	1.02	20	1.73	1.02	1.10	1.10
5	.....	2.85	1.00	1.27	21	3.20	1.02	1.10	1.05
6	.....	2.70	1.00	1.10	22	2.20	1.00	1.05	1.05
7	.....	(a)	1.10	1.10	23	2.35	1.00	1.05	1.02
8	.....	.....	1.10	1.22	24	2.30	1.00	1.05	1.00
9	1.83	.....	1.10	1.47	25	2.32	1.00	1.05	1.00
10	1.79	.....	1.02	1.30	26	2.50	1.00	1.05	1.00
11	1.75	1.45	1.00	1.20	27	2.32	1.00	1.02	1.00
12	1.95	1.29	1.00	1.17	28	2.19	1.00	1.00	1.00
13	2.15	1.30	1.00	1.10	29	2.10	1.66	1.02	1.00
14	2.07	1.15	.97	1.10	30	2.32	1.02	1.08	.95
15	2.00	1.02	1.00	1.02	31	.....	.91	.....	.95
16	1.90	1.02	1.07	1.02					

[a] Gage destroyed by flood October 6; temporary gage put in October 11.

GILA RIVER AT SAN CARLOS, ARIZ.

The general character of the country through which the Gila River flows is a high and rolling plateau, with the river flowing through it in a deep canyon, and with practically no agricultural lands within its area. The river emerges from its upper canyon about 10 miles before it reaches the Arizona line, and thence flows through a valley of considerable width, known as Duncan Valley, until just before it receives the waters of San Francisco River.

Gila River is in a canyon for about 20 miles below the mouth of the San Francisco, or to within 10 miles of Solomonsville. At this point the hills separate, forming a large valley, which has been extensively settled and is now one of the finest irrigated portions of the Territory. This valley extends from a point 10 miles above Solomonsville to 6 miles below the mouth of San Carlos River, on the White Mountain Indian Reservation. At this latter place the mountains suddenly close in again and the river enters another canyon. Seven miles below the Indian agency at San Carlos the canyon narrows to a width of 100 feet, and at this point is located the San Carlos dam site, which was studied by the United States Geological Survey during 1899, in connection with the investigation of the water supply of Gila River. The results of this investigation are published in Water-Supply and Irrigation Paper No. 33, entitled "Storage of Water on Gila River, Arizona," by J. B. Lippincott. In connection with this investigation Cyrus C. Babb, on July 11, 1899, established a station on Gila River one-half mile south of the Indian agency at San Carlos and below the mouth of San Carlos Creek, where an inclined rod securely fastened to posts driven into the bank was erected. The original bench mark was a 20-penny nail in the base of a mesquite tree 5 inches in diameter, 85 feet west of the gage rod, at an elevation of 12.67 feet above gage datum. It was destroyed by a flood in the spring of 1903. A new bench mark was established May 9, 1903, by C. R. Olberg. It consists of a nail head in the west side of the post which supports the cable on the right bank of the river. Its elevation is 14.54 feet above the zero of the gage. The observer is R. H. Ross, who also makes the discharge measurements. Discharge measurements are made from a cable and car a short distance above the gage rod. The channel is straight for some distance above and below the station, and the water is comparatively swift. The right bank is high, but the left is low and liable to overflow. The bed of the stream is sandy and shifting.

The observations at this station during 1904 have been made under the direction of C. G. Williams, district hydrographer.

Discharge measurements of Gila River at San Carlos, Ariz., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.	Ditch discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec. feet.*	
January 10	R. H. Ross	34	1.03	1.35	36	.....
January 17	do	31	1.11	1.35	34	.....
January 24	do	20	1.46	1.35	29	.....
January 30	do	20	1.48	1.35	30	.....
February 7	do	40	1.19	1.4	48	.....
February 14	do	30	.90	1.4	28	.....
February 21	do	32	.96	1.4	31	.....
February 28	do	20	1.00	1.3	20	.....
March 2	do	11	1.17	1.3	13	.....
March 2	do	10	1.01	1.3	10	4.9
March 10	do	10	.90	1.25	9.4	4.5
March 19	do	11	1.06	1.25	12	5.1
March 28	do	10	.91	1.25	9.5	4.5
April 4	do	11	.88	1.2	9.6	3.9
April 11	do	7.6	.96	1.15	7.4	3.2
April 21	do	4.4	.56	1.05	2.5	7.0
April 29	do	4.4	.52	1.05	2.3	6.5
May 7	do	2.8	.68	.0	1.9	6.0
May 12	do	32	1.34	1.3	43	.0
May 13	do	61	1.44	1.5	88	.0
May 20	do	0.0	.00	.0	0.0	2.3
July 21	do	67	2.43	1.7	163	.....
July 22	do	102	34.40	2.1	351	.....
July 23	do	117	3.86	2.2	452	.....
July 25	do	58	2.21	1.75	129	.....
July 26	do	137	1.79	1.95	246	.....
July 27	do	182	3.17	2.7	578	.....
July 28	do	166	2.65	2.4	441	.....
July 29	do	93	1.48	1.8	138	.....
July 30	do	255	7.05	3.5	1,801	.....
July 30	do	246	6.03	3.2	1,487	.....
July 31	do	180	3.21	2.5	578	.....
August 1	do	131	3.17	2.1	415	.....
August 2	do	176	2.91	2.6	511	.....
August 3	do	203	4.32	2.95	880	.....
August 4	do	153	3.10	2.45	475	.....
August 5	do	183	2.98	2.65	548	.....
August 5	do	331	7.57	4.1	2,511	.....
August 6	do	235	5.80	3.1	1,365	.....
August 6	do	331	7.54	4.15	2,500	.....

Discharge measurements of Gila River at San Carlos, Ariz., in 1904—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.	Ditch discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec. feet.*	
August 7	R. H. Ross	287	6.45	3.2	1,851	.....
August 8	do	241	5.13	2.8	1,238	.....
August 9	do	140	2.58	2.1	361	.....
August 10	do	127	2.27	2.0	287	.....
August 11	do	182	4.75	2.7	868	.....
August 13	do	146	3.05	2.5	444	.....
August 14	do	115	2.96	2.2	341	.....
August 16	do	341	9.90	4.2	3,375	.....
August 17	do	300	6.80	3.4	2,039	.....
August 18	do	185	4.03	2.75	746	.....
August 19	do	242	2.72	2.3	658	.....
August 20	do	318	5.29	3.1	1,681	.....
August 21	do	355	6.61	3.5	2,345	.....
August 25	do	231	3.80	3.0	877	.....
August 25	do	179	3.74	2.4	671	.....
August 26	do	168	2.55	2.3	428	.....
August 28	do	222	4.92	2.9	1,092	.....
August 29	do	177	3.45	2.4	611	.....
September 4	do	167	3.82	2.3	639	.....
September 5	do	230	5.07	2.9	1,168	.....
September 6	do	194	3.80	2.6	739	.....
September 8	do	129	2.14	2.2	277	.....
September 11	do	46	1.53	1.65	71	.....
September 12	do	129	3.74	2.5	483	.....
September 14	do	90	2.31	2.1	209	.....
September 16	do	68	2.42	2.0	166	.....
September 18	do	62	1.72	1.85	107	.....
September 23	do	106	2.46	2.1	261	.....
September 28	do	26	1.22	1.5	32	.....
October 6	do	45	1.89	1.7	85	.....
October 8	do	447	8.97	5.5	4,007	.....
October 9	do	753	6.78	6.5	5,113	.....
October 10	do	910	6.64	7.1	6,043	.....
October 12	do	198	5.14	2.8	1,018	.....
October 14	do	150	3.37	2.4	507	.....
October 16	do	127	2.90	2.2	369	.....
October 18	do	179	2.70	2.0	485	.....
October 20	do	174	2.39	1.9	417	.....
October 22	do	162	1.98	1.8	322	.....
October 2[illegible]	do	103	1.77	1.6	182	.....

Discharge measurements of Gila River at San Carlos, Ariz., in 1904—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.	Ditch discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec. feet.*	
October 30	R. H. Ross	88	1.79	1.55	158	.....
November 6	do	81	1.80	1.55	147	.....
November 14	do	62	1.90	1.45	118	.....
November 21	do	55	1.38	1.35	77	.....
November 28	do	46	1.42	1.3	66	5.7
December 4	do	46	1.01	1.3	47	7.9
December 6	do	202	2.67	2.5	541	8.7

Mean daily gage height, in feet, of Gila River at San Carlos Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.35	1.35	1.30	1.25	1.05	(b)	(b)	1.90	2.18	1.45	1.65	1.25
2	1.35	1.35	1.30	1.25	1.05	(b)	(b)	2.60	1.90	1.45	1.65	1.25
3	1.35	1.35	1.30	1.20	1.05	(b)	(b)	3.02	1.95	1.45	1.60	1.25
4	1.35	1.35	1.30	1.20	1.05	(b)	(b)	2.25	2.85	1.45	1.60	1.30
5	1.35	1.35	1.30	1.20	1.05	(b)	(b)	3.28	2.88	1.45	1.58	1.30
6	1.35	1.38	1.30	1.20	1.02	(b)	(b)	3.60	2.50	1.65	1.55	2.45
7	1.35	1.40	1.30	1.20	(a)	(b)	(b)	3.50	2.15	3.15	1.55	2.25
8	1.35	1.40	1.28	1.20	(a)	(b)	(b)	2.60	1.85	5.60	1.55	2.10
9	1.35	1.40	1.25	1.15	(a)	(b)	(b)	2.05	1.70	6.60	1.50	2.10
10	1.35	1.40	1.25	1.15	(a)	(b)	(b)	2.60	1.70	7.05	1.50	2.20
11	1.35	1.40	1.25	1.15	(a)	(b)	(b)	2.65	1.65	3.85	1.50	2.20
12	1.35	1.40	1.25	1.10	1.50	(b)	(b)	2.58	2.08	2.75	1.48	2.20
13	1.35	1.40	1.25	1.10	1.60	(b)	(b)	2.35	2.40	2.55	1.45	2.10
14	1.35	1.40	1.25	1.05	1.20	(b)	(b)	2.20	2.05	2.38	1.45	1.90
15	1.35	1.40	1.25	1.05	1.10	(b)	(b)	1.95	1.90	2.28	1.42	1.90
16	1.35	1.40	1.25	1.05	1.00	(b)	(b)	3.35	2.10	2.20	1.40	1.85
17	1.35	1.40	1.25	1.05	(a)	(b)	(b)	3.25	2.00	2.25	1.40	1.80
18	1.35	1.40	1.25	1.05	(a)	(b)	(b)	2.68	1.82	2.00	1.40	1.80
19	1.35	1.40	1.25	1.05	(a)	(b)	(b)	2.15	1.75	1.90	1.40	1.80
20	1.35	1.40	1.25	1.05	(b)	(b)	(b)	2.80	1.62	1.90	1.35	1.75
21	1.35	1.40	1.25	1.05	(b)	(b)	1.50	3.50	1.60	1.90	1.35	1.75
22	1.35	1.40	1.25	1.05	(b)	(b)	1.95	2.90	1.55	1.80	1.35	1.70
23	1.35	1.40	1.25	1.05	(b)	(b)	2.20	4.10	2.05	1.80	1.32	1.70
24	1.35	1.40	1.25	1.05	(b)	(b)	2.10	2.95	1.75	1.80	1.35	1.65
25	1.35	1.40	1.25	1.05	(b)	(b)	1.95	2.35	1.70	1.70	1.30	1.62
26	1.35	1.40	1.25	1.05	(b)	(b)	1.80	2.15	1.60	1.60	1.30	1.60
27	1.35	1.35	1.25	1.05	(b)	(b)	2.05	2.10	1.50	1.60	1.30	1.60
28	1.35	1.30	1.25	1.05	(b)	(b)	2.30	2.50	1.50	1.60	1.30	1.60
29	1.35	1.30	1.25	1.05	(b)	(b)	1.70	2.50	1.50	1.60	1.30	1.60
30	1.35	.....	1.25	1.05	(b)	(b)	3.30	2.30	1.45	1.55	1.25	1.55
31	1.35	.....	1.25	.....	(b)	(b)	2.60	2.15	.....	1.55	.....	1.55

a No water at gage.

b River dry May 20 to July 20.

Mean daily discharge, in second-feet, of Gila River at San Carlos, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	27	31	15	12	2	(a)	(a)	250	440	20	210	38
2	28	31	12	12	2	(a)	(a)	511	220	20	210	35
3	29	31	12	9	2	(a)	(a)	940	270	20	180	31
4	30	32	12	10	2	(a)	(a)	330	1,300	20	175	47
5	31	32	12	10	2	(a)	(a)	1,400	1,168	20	165	45
6	32	40	12	10	2	(a)	(a)	1,900	640	70	147	500
7	33	48	12	10	2	(a)	(a)	2,300	320	1,040	150	400
8	34	45	9	10	2	(a)	(a)	960	120	4,130	150	500
9	35	42	9	7	2	(a)	(a)	320	75	5,330	130	550
10	36	39	9	7	1	(a)	(a)	960	80	5,870	130	660
11	36	37	9	7	1	(a)	(a)	810	71	1,540	135	660
12	35	34	9	5	88	(a)	(a)	630	215	970	120	660
13	35	31	10	5	115	(a)	(a)	340	400	710	115	575
14	35	28	10	4	26	(a)	(a)	341	185	507	118	400
15	35	29	11	4	12	(a)	(a)	240	130	420	106	400
16	34	29	11	4	3	(a)	(a)	2,040	210	369	93	365
17	34	29	12	3	2	(a)	(a)	1,810	165	545	94	330
18	33	30	12	3	2	(a)	(a)	680	95	485	95	330
19	32	30	12	3	1	(a)	(a)	490	85	410	96	330
20	32	31	12	3	(a)	(a)	(a)	1,230	60	417	77	290
21	31	31	12	2	(a)	(a)	65	2,345	60	400	77	290
22	31	32	11	2	(a)	(a)	230	1,000	50	322	80	260
23	30	33	11	2	(a)	(a)	452	3,200	230	320	70	260
24	29	35	11	2	(a)	(a)	360	1,100	100	320	80	225
25	29	36	11	2	(a)	(a)	260	490	85	245	60	210
26	29	37	10	2	(a)	(a)	150	300	55	185	62	195
27	29	27	10	2	(a)	(a)	235	300	32	182	64	195
28	30	20	10	2	(a)	(a)	350	660	32	180	66	195
29	30	17	10	2	(a)	(a)	90	730	32	180	62	195
30	30	.....	11	2	(a)	(a)	1,580	530	20	158	42	165
31	30	.....	11	.....	(a)	.....	670	390	.....	155	.....	165

a River dry.

Estimated monthly discharge of Gila River at San Carlos, Ariz., for 1904.

[Drainage area 13,460 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	36	27	31.7	1,949	0.0024	0.0028
February	48	17	32.6	1,875	.0024	.0026
March	15	9	11.0	676	.00082	.00095
April	12	2	5.3	315	.00039	.00044
May	115	0	8.7	535	.00065	.00075
June	0	0	0	0	0.000	0.000
July	1,580	0	143	8,793	.011	.013
August	3,200	240	952	58,540	.071	.082
September	1,300	20	232	13,800	.017	.019
October	5,870	20	825	50,730	.061	.070
November	210	42	112	6,664	.0083	.0093
December	660	31	306	18,820	.023	.027
The year	5,870	0	222	162,700	.0165	.228

NOTE.—The above estimates have been prepared by interpolation based upon the discharge measurements and gage heights owing to the shifting character of the bed.

GILA RIVER NEAR GILA CITY, ARIZ.

On October 15, 1903, a station was established near Gila City, Ariz., by W. D. Smith. The station is located one-fourth mile north of Gila City, and 14 miles east of Yuma, Ariz. The gage is a 4 by 4 inch vertical post buried 6 feet in the ground on the left bank of the river. It is read twice each day by O. F. Thornton. Discharge measurements are made by means of a boat and cable. The initial point for soundings is an iron stake driven to the surface of the ground on the left bank 7.7 feet from the gage. The channel is straight for 100 feet above and 900 feet below the station. Velocity is swift. The right bank is low and not subject to overflow. The left bank is above high water. The bed of the stream is composed of silt and sand and is subject to continual change. The bench mark is a standard United States Geological Survey bronze cap, located at the Southern Pacific railway depot, at Gila City, and has an elevation of 189.60 feet above sea level. Its elevation above the zero of the gage is 31.98 feet.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Gila River near Gila City, Ariz., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 1	W. D. Smith	5.90	1,433
August 15	do	5.15	718
September 8	S. M. Smith	5.70	900
September 16	do	4.80	543
September 27	W. D. Smith	3.10	164
October 13	do	7.35	2,379
October 14	do	7.65	2,595

Mean daily gage height, in feet, of Gila River near Gila City, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	.....	.....	.....	6.10	7.50	2.80	3.90	.....
2	.....	.....	.....	.....	.....	.....	.....	6.55	(a)	2.75	3.80	.....
3	.....	.....	.....	.....	.....	.....	.....	6.90	.....	2.65	3.80	.....
4	.....	.....	.....	.....	.....	.....	.....	7.00	.....	2.65	3.70	.....
5	.....	.....	.....	.....	.....	.....	.....	7.50	.....	2.60	3.70	.....
6	.....	.....	.....	.....	.....	.....	.....	8.35	.....	2.60	3.60	.....
7	.....	.....	.....	.....	.....	.....	.....	5.55	.....	2.60	3.60	.....
8	.....	.....	.....	.....	.....	.....	.....	5.50	5.70	2.60	3.60	.....
9	.....	.....	.....	.....	.....	.....	.....	7.50	5.20	2.50	3.50	.....
10	.....	.....	.....	.....	.....	.....	.....	7.75	4.90	2.50	3.50	.....
11	.....	.....	.....	.....	.....	.....	.....	6.80	4.70	2.50	3.50	.....
12	.....	.....	.....	.....	.....	.....	.....	7.20	4.50	6.60	3.45	.....
13	.....	.....	.....	.....	.....	.....	.....	7.55	4.25	7.20	3.45	.....
14	.....	.....	.....	.....	.....	.....	.....	6.35	3.95	7.70	3.45	.....
15	.....	.....	.....	.....	.....	.....	.....	5.15	5.70	7.05	3.40	.....
16	.....	.....	.....	.....	.....	.....	.....	4.00	4.70	5.70	3.40	.....
17	.....	.....	.....	.....	.....	.....	.....	4.95	4.70	4.90	3.30	.....
18	.....	.....	.....	.....	.....	.....	.....	5.65	4.20	4.55	3.20	.....
19	.....	.....	.....	.....	.....	.....	.....	6.40	4.00	4.45	3.10	.....
20	.....	.....	.....	.....	.....	.....	.....	7.30	4.00	4.90	3.00	.....
21	.....	.....	.....	.....	.....	.....	.....	7.70	3.70	4.95	2.90	.....
22	.....	.....	.....	.....	.....	.....	.....	8.05	3.50	4.85	2.90	.....
23	.....	.....	.....	.....	.....	.....	.....	8.15	3.45	4.70	2.90	.....
24	.....	.....	.....	.....	.....	.....	.....	7.90	3.25	4.65	2.90	.....
25	.....	.....	.....	.....	.....	.....	.....	7.95	3.15	4.50	2.90	.....
26	.....	.....	.....	.....	.....	.....	.....	8.05	2.90	4.40	2.90	.....
27	.....	.....	.....	.....	.....	.....	.....	8.20	3.05	4.25	.....	.....
28	.....	.....	.....	.....	.....	.....	.....	8.45	2.95	4.20	.....	.....
29	.....	.....	.....	.....	.....	.....	.....	9.20	2.85	4.10	.....	.....
30	.....	.....	.....	.....	.....	.....	6.00	9.65	2.85	4.00	.....	.....
31	.....	.....	.....	.....	.....	.....	6.50	8.10	.....	3.90	.....	.....

[a] Gage washed out; replaced Sept. 8.

NOTE.—River dry from January 1 to July 29, inclusive, and from November 27 to December 31, inclusive.

Estimated monthly discharge of Gila River near Gila City, Ariz., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January			0.0	0
February			0.0	0
March			0.0	0
April			0.0	0
May			0.0	0
June			0.0	0
July	1,650	0	94.2	5,792
August	4,560	940	2,270	139,600
September	2,490	50	700	41,700
October	2,670	10	534	32,800
November	260	0	109	6,486
December	0	0	0.0	0
The period	4,560	0	312	226,400

SAN FRANCISCO RIVER AT ALMA, N. MEX.

This station was established October 18, 1904, by W. A. Farish. It is located about one-half mile southwest of Alma, N. Mex., and 85 miles northwest of Silver City, N. Mex. It is best reached by stage from Silver City, which makes trips daily except Sundays. A staff gage is fastened to the east or left bank of the stream. The station is equipped with a one-half inch cable and tagged wire, with tags 5 feet apart. The initial point for soundings is the zero of the tagged wire. The channel is straight for about 500 feet above and below the station. The current is swift. Both banks are about 4 feet high, clean, and subject to overflow during extreme high water. The bed of the stream is composed of gravel, free from vegetation, firm, and regular. The bench mark is a 20-penny nail driven into a cottonwood tree, marked "U. S. G. S. B. M." in a blaze north 73° east 118.5 feet from the gage. Its elevation is 9.06 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of W. A. Farish, district hydrographer.

Discharge measurements on San Francisco River at Alma, N. Mex., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 19	W. A. Farish	1.85	96
August 19	do	2.40	230
August 21	do	3.00	756
September 1	do	4.00	1,582
October 9	do	2.05	151

NOTE—These measurements were all made by floats.

Mean daily gage height, in feet, of San Francisco River, at Alma, N. Mex., for 1904.

Day	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.77	.....	1.45	1.4	17	.....	.....	1.4	1.4	1.35
2	.....	1.52	.....	1.45	1.4	18	2.10	.....	1.4	1.4	1.35
3	.....	1.47	.....	1.45	2.4	19	2.10	.....	1.4	1.4	1.35
4	.....	1.62	5.0	1.45	1.9	20	1.62	.....	1.4	1.4	1.4
5	.....	2.57	1.8	1.45	1.85	21	2.02	.....	1.4	1.4	1.4
6	.....	([a])	1.45	1.4	1.45	22	2.02	.....	1.4	1.4	1.4
7	.....	.....	1.5	1.4	1.5	23	3.07	.....	1.4	1.37	1.36
8	.....	.....	4.15	1.4	1.7	24	3.30	.....	1.4	1.37	1.36
9	.....	.....	2.2	1.4	1.45	25	1.97	.....	1.4	1.4	1.37
10	.....	.....	1.42	1.4	1.4	26	1.85	.....	1.4	1.4	1.4
11	.....	.....	1.42	1.4	1.4	27	1.97	.....	1.4	1.4	1.4
12	.....	.....	1.4	1.4	1.4	28	1.95	.....	1.4	1.4	1.4
13	.....	.....	1.45	1.4	1.4	29	1.80	.....	1.45	1.4	1.4
14	.....	.....	1.4	1.4	1.4	30	1.57	.....	1.45	1.4	1.4
15	.....	.....	1.4	1.4	1.35	31	1.52	.....	1.45	.....	1.4
16	.....	.....	1.4	1.4	1.35						

[a] September 6 to October 3, inclusive, the gage height was approximately 1.1. A bar formed making the gage useless.

Mean daily discharge, in second-feet, of San Francisco River at Alma, N. Mex., for 1904.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	470	10	55	.....	17	.....	10	47	45	.....
2	.....	60	10	55	.....	18	150	10	47	45	.....
3	.....	60	10	55	.....	19	150	10	47	.....	.....
4	.....	68	2,000	55	.....	20	70	10	47	.....	.....
5	.....	350	100	55	.....	21	135	10	47	.....	.....
6	.....	48	50	45	.....	22	135	10	47	.....	.....
7	.....	10	60	45	.....	23	690	10	47	.....	.....
8	.....	10	270	45	.....	24	195	10	47	.....	.....
9	.....	10	170	45	.....	25	128	10	47	.....	.....
10	.....	10	230	45	.....	26	110	10	47	.....	.....
11	.....	10	230	45	.....	27	128	10	47	.....	.....
12	.....	10	225	45	.....	28	128	10	47	.....	.....
13	.....	10	50	45	.....	29	100	10	55	.....	.....
14	.....	10	47	45	.....	30	70	10	55	.....	.....
15	.....	10	47	45	.....	31	60	.....	55	.....	.....
16	.....	10	47	45	.....						

NOTE.—The above is based on the float measurements and is approximate only.

Estimated monthly discharge of San Francisco River at Alma, N. Mex., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
August 18–31	690	60	161	4,470
September	470	10	43.2	2,571
October	2,000	10	138	8,485
November 1–18	55	45	47.8	1,709

SAN PEDRO RIVER AT CHARLESTON, ARIZ.

This station was established January 22, 1904, by H. R. Evans. It is located about one-half mile west of Charleston station on the El Paso and Southwestern Railroad, and 6 miles south of Fairbank, Ariz. The original gage was read until March 28. From March 29 to July 30 readings were from a second gage established March 24, 200 feet upstream from the first gage. The second gage is composed of two sections. The upper section is attached vertically to a cottonwood tree on the left bank and the lower part is inclined, having its upper end fastened to the same tree and the lower end set in the bed of the stream. The July and August floods changed the channel so that a third gage was necessary. This was established August 15, directly opposite the old or second gage, on the east bank, and consisted of a vertical rod fastened to a deadman in the bank at the same datum as the old gage. Readings were made from the third gage for the remainder of the year. The gage is read twice each day by H. R. Fry, who also makes the discharge measurements. Discharge measurements are made by means of a cable and car 10 feet below the gage during high water and by wading during low water. The initial point for soundings is 21 feet from the cable support on the east bank. Sounding points are indicated by means of a tagged line marked every 10 feet. The channel is straight for about 800 feet above and 500 feet below the station, and the current is swift. Both banks are nearly vertical for 20 feet, clean, and do not overflow. The bed of the stream is composed of sand and is shifting. At high water there is but one channel and at low water it is divided by sand bars. Bench mark No. 1 is a United States Geological Survey standard iron bench-mark post near a post on the east side of the El Paso and Southwestern Railroad station at Charleston. Its elevation is 57.265 feet above the zero of the gage and 3,957.265 feet above mean sea level. Bench mark No. 2 is a spike in the west side of the root of a tree on the west bank of the river, 100 feet above the gage. Its elevation is 35.860 feet above the zero of the gage and 3,935.860 feet above mean sea level.

The observations at this station during 1904 have been made under the direction of C. G. Williams, district hydrographer.

Discharge measurements on San Pedro River at Charleston, Ariz., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
April 20	H. R. Fry	28	0.94	28.78	26
April 27	do	27	.85	28.8	23
May 4	do	20	.94	28.82	19
May 11	do	38	1.56	29.3	59
May 18	do	32	.98	28.95	31
May 25	do	46	1.21	29.05	56
June 1	do	11	.89	28.7	10
June 18	do	14	1.02	28.75	14
June 22	do	13	.66	28.75	9
June 29	do	19	.70	28.7	14
July 6	do	18	.64	28.7	12
July 13	do	16	.72	28.65	11
July 15	do	59	2.51	29.67	148
July 20	do	51	1.27	29.05	64
July 22	do	131	3.40	29.92	445
July 23 [a]	do	258	8.45	32.6	2,180
July 23 [a]	do	310	8.07	33.3	2,502
July 23 [a]	do	157	4.03	31.1	633
July 26 [a]	do	544	9.23	36.2	5,026
July 27 [a]	do	573	9.30	36.5	5,326
July 30 [a]	do	788	12.16	38.6	9,566
August 17 [a]	do	187	2.81	28.3	524
August 20 [a]	do	451	5.97	31.5	2,694
August 21 [a]	do	310	5.41	29.8	1,678
August 29	do	34	2.09	26.2	72
September 8 [b]	do	41	1.95	25.8	80
September 13 [a]	do	131	2.58	27.6	338
September 14	do	49	2.49	26.6	122
September 22 [b]	do	34	1.65	26.2	57
September 30	do	27	1.64	26.0	45
September 30 [b]	do	23	1.92	26.0	44
October 6	do	29	1.52	26.2	44
October 12	do	26	1.60	25.95	42
October 19	do	24	1.63	25.8	39
October 24 [a]	do	162	3.00	28.0	484
November 9	do	19	1.53	26.2	29
November 16	do	20	1.56	26.15	32
November 23	do	19	1.62	26.05	31

[a] Measurement made by floats.

[b] Measurement made above station.

Discharge measurements on San Pedro River at Charleston, Ariz., in 1904—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
November 30	H. R. Fry	19	1.61	26.0	30
December 7	do	20	1.64	26.15	34
December 14	do	21	1.60	26.05	33
December 21	do	18	1.63	26.15	29
December 28	do	23	1.54	26.15	35

Mean daily gage height, in feet, of San Pedro River at Charleston, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	28.50	28.45	28.80	28.78	28.70	28.75	30.15	27.40	26.00	26.30	26.00
2	.....	28.50	28.45	28.80	28.78	28.70	28.68	29.15	26.65	26.05	26.30	26.05
3	.....	28.50	28.45	28.78	28.78	28.70	28.65	29.55	26.35	26.35	26.22	26.10
4	.....	28.52	28.40	28.80	28.82	28.78	28.65	29.30	26.35	26.20	26.30	26.10
5	.....	28.51	28.35	28.75	28.80	28.75	28.65	29.10	26.05	26.10	26.28	26.08
6	.....	28.50	28.35	28.78	28.75	28.78	28.70	28.75	25.85	26.20	26.25	26.10
7	.....	28.50	28.35	28.80	28.72	28.75	28.70	28.50	25.82	26.15	26.25	26.15
8	.....	28.50	28.35	28.80	28.78	28.80	28.70	29.50	25.80	26.20	26.20	26.18
9	.....	28.48	28.30	28.80	28.78	28.72	28.65	27.95	25.80	26.20	26.20	26.10
10	.....	28.48	28.28	28.82	28.78	28.68	28.62	28.35	25.90	26.17	26.20	26.10
11	.....	28.44	28.28	28.82	29.65	28.72	28.65	28.00	25.80	25.98	26.20	26.10
12	.....	28.48	28.35	28.80	29.42	28.78	28.62	.....	25.50	25.95	26.15	26.10
13	.....	28.48	28.40	28.82	29.12	28.75	28.62	.....	27.30	26.00	26.15	26.10
14	.....	28.46	28.38	28.82	29.08	28.78	28.62	.....	26.65	25.98	26.15	26.05
15	.....	28.49	28.40	28.78	29.00	28.78	29.58	26.60	26.35	25.90	26.15	26.05
16	.....	28.43	28.40	28.72	29.00	28.80	29.75	30.95	26.60	25.92	26.15	26.10
17	.....	28.66	[a]28.60	28.72	28.92	28.75	[c]29.35	28.25	26.20	25.92	26.15	26.10
18	.....	28.47	28.50	28.72	28.92	28.72	29.60	[g]28.20	26.05	25.90	26.12	26.10
19	.....	28.50	28.48	28.78	28.85	28.75	29.85	28.10	26.10	25.80	26.10	26.10
20	.....	28.45	28.45	28.78	28.80	28.75	[d]29.28	30.15	26.00	25.80	26.10	26.10
21	.....	.....	28.40	28.78	28.82	28.75	[e]29.05	28.55	25.92	25.80	26.10	26.15
22	.....	.....	28.42	28.78	28.80	28.72	30.40	27.80	26.15	25.85	26.10	26.15
23	.....	.....	28.42	28.75	28.80	28.72	[f]31.85	27.60	26.20	25.80	26.05	26.10
24	.....	.....	28.45	28.78	28.78	28.72	29.60	[h]28.65	26.20	27.30	26.05	26.10
25	.....	.....	28.50	28.78	29.05	28.72	30.25	26.90	26.10	26.22	26.05	26.10
26	.....	.....	28.52	28.78	28.98	28.72	33.70	27.00	26.05	26.22	26.05	26.05
27	28.40	.....	28.55	28.80	28.85	28.72	34.25	26.50	26.00	26.32	26.05	26.10
28	28.30	28.50	[b]28.52	28.78	28.80	28.78	29.20	26.20	25.95	26.30	26.00	26.15
29	28.82	28.50	28.80	28.78	28.78	28.72	30.20	26.20	25.93	26.30	26.00	26.15
30	.....	.....	28.75	28.78	28.75	28.75	41.25	26.35	26.00	26.25	26.00	26.10
31	.....	.....	28.80	.....	28.72	.....	32.40	26.70	.....	26.25	.....	26.15

[a] Dam above washed out. Water rose to 30-foot gage height during the night.
[b] New gage installed March 28, 1904.
[c] Gage 30.2 feet during night of July 17.
[d] Gage 31.0 feet during night of July 20.
[e] Gage 34.0 feet during night of July 21.
[f] Gage 33.3 feet at noon of July 23.
[g] Gage 30.1 feet during night of August 18.
[h] Gage 31.4 feet at 9 a. m. and 32.3 at 12 m. on August 24.

NOTE.—January 27 to March 28 from gage No. 1; March 29 to August 11 from gage No. 2; August 15 to December 31 from gage No. 3.

Mean daily discharge, in second-feet, of San Pedro River at Charleston, Ariz., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	22	20	12	17	1,730	320	41	36	28
2	.....	22	20	10	11	1,080	180	42	36	29
3	.....	20	20	10	8	1,330	130	69	30	30
4	.....	22	19	17	8	1,175	137	50	36	27
5	.....	17	16	14	8	1,050	95	38	34	24
6	.....	20	13	17	12	950	74	44	32	23
7	.....	22	10	14	12	820	77	43	32	24
8	.....	22	15	19	12	1,300	80	50	29	29
9	.....	22	15	11	9	555	66	54	29	26
10	.....	24	15	9	7	740	66	55	29	28
11	.....	24	112	11	10	575	45	40	29	30
12	.....	22	78	17	8	.....	20	42	30	32
13	.....	24	41	14	9	.....	265	46	32	35
14	.....	24	38	15	9	.....	130	47	32	34
15	.....	20	31	15	132	100	82	42	32	32
16	.....	14	33	17	166	2,330	120	45	32	34
17	.....	14	26	11	102	510	62	47	32	32
18	.....	15	28	9	148	490	46	46	31	31
19	.....	26	23	10	200	470	50	39	31	30
20	.....	26	20	10	100	1,660	40	39	32	28
21	.....	26	22	10	100	890	33	39	33	29
22	.....	26	22	6	690	500	52	43	34	30
23	.....	21	24	8	1,400	425	57	39	31	27
24	.....	23	23	9	100	900	59	260	31	28
25	.....	22	56	10	325	220	50	30	31	29
26	.....	22	46	11	2,750	240	46	30	31	26
27	.....	23	30	13	3,250	125	42	38	31	31
28	.....	20	24	20	500	75	39	36	30	35
29	22	20	20	16	1,500	72	38	36	30	36
30	17	20	17	18	12,000	98	45	32	30	34
31	22	.....	13	.....	3,550	170	.....	32	.....	38

Estimated monthly discharge of San Pedro River at Charleston, Ariz., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March 29–31	22	17	20.3	121
April	26	14	21.5	1,279
May	112	10	28.7	1,765
June	20	6	12.8	762
July	12,000	7	876	58,860
August 1–11 and 15–31	2,330	72	735	40,820
September	320	20	84.9	5,052
October	260	30	49.5	3,044
November	36	29	31.6	1,880
December	38	23	30.0	1,845
The period	.....	.....	.....	110,400

NOTE.—The above estimates have been prepared by interpolation based upon the discharge measurements and gage heights.

SALT RIVER AT ROOSEVELT, ARIZ.

This station, established February 7, 1901, by H. G. Heisler, is located at the town of Roosevelt, which is the United States Geological Survey construction camp for the Salt River dam and reservoir, and is about 12 miles west of Livingston. In reports previous to 1903 this station was called Salt River, at reservoir site below Tonto Creek, near Livingston, Ariz.

The gage rod and cable are at the upper end of the gorge, about 2,000 feet below the mouth of Tonto Creek and 1,500 feet above the dam site. The gage is a vertical rod fastened to the rocks on the left bank of the river. Gagings are made from a car and cable.

The observations at this station during 1904 have been made under the direction of C. G. Williams, district hydrographer.

Discharge measurements of Salt River at Roosevelt, Ariz., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per sec.*	*Feet.*	*Second-feet.*
January 2	O. Richins	111	2.01	7.18	224
February 29	do	112	1.94	7.19	216
March 15	do	118	1.93	7.20	228
March 20	do	115	1.87	7.17	216
March 31	do	112	1.74	7.16	195
April 9[a]	do	86	1.78	7.15	153
April 16[a]	do	88	1.63	7.10	143
May 9[a]	do	74	1.66	7.05	122
May 10	do	176	2.62	7.80	462
May 21	do	74	1.67	7.06	124
May 28	do	68	1.68	7.00	115
June 4	do	60	1.54	6.97	93
June 18	do	53	1.44	6.92	76
June 28	do	50	1.31	6.88	66
July 16	do	46	1.13	6.80	52
July 23[b]	do	270	3.23	8.45	873
July 25[b]	do	455	5.43	9.40	2,470
July 26[b]	do	1,598	10.00	15.30	15,980
August 4[b]	do	405	4.45	8.90	1,800
August 16[b]	do	418	4.41	9.05	1,850
August 17[b]	do	851	7.70	13.30	553
August 23[b]	do	709	9.00	12.70	385
August 23[b]	do	1,687	11.00	15.90	18,560
August 23[b]	Hill and Richins	1,935	12.00	17.40	23,200
August 30[b]	O. Richins	500	6.00	9.50	3,000
September 26	do	105	1.56	6.95	165

[a] Measurement made below regular station. [b] Measurement made by floats.

Discharge measurements of Salt River at Roosevelt, Ariz., in 1904—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per sec.*	*Feet.*	*Second-feet.*
October 7	O. Richins	241	2.62	7.87	632
October 13	do	231	2.22	7.74	514
October 21	do	157	1.48	7.10	232
October 28	do	135	1.44	6.96	195
November 4	do	140	1.28	6.95	178
November 18	do	133	1.24	6.91	164
November 26	do	132	1.24	6.91	164
December 2	do	135	1.25	6.91	169
December 9	do	144	1.47	7.04	211
December 23	do	135	1.28	6.95	174

Mean daily gage height, in feet, of Salt River at Roosevelt, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.18	7.18	7.18	7.17	7.05	6.99	6.87	8.02	7.72	6.93	6.93	6.91
2	7.18	7.18	7.18	7.17	7.05	6.98	6.86	7.90	7.65	6.92	6.93	6.91
3	7.18	7.18	7.18	7.16	7.05	6.97	6.85	8.05	7.60	6.92	6.93	6.91
4	7.18	7.18	7.19	7.16	7.05	6.97	6.84	8.85	7.52	6.91	6.92	6.92
5	7.18	7.18	7.19	7.16	7.05	6.97	6.83	8.30	7.48	6.90	6.92	6.92
6	7.18	7.20	7.19	7.16	7.05	6.96	6.82	7.70	7.45	6.90	6.92	6.93
7	7.18	7.19	7.19	7.16	7.05	6.96	6.82	7.75	7.45	7.77	6.92	6.95
8	7.18	7.19	7.19	7.15	7.05	6.95	6.82	7.90	7.40	7.85	6.92	7.09
9	7.18	7.18	7.19	7.15	7.04	6.94	6.81	7.72	7.40	7.35	6.92	7.05
10	7.18	7.18	7.19	7.14	7.47	6.94	6.81	8.42	7.40	7.25	6.92	7.00
11	7.18	7.18	7.19	7.14	7.10	6.94	6.81	7.90	7.40	7.25	6.92	6.97
12	7.18	7.18	7.20	7.13	7.20	6.94	6.80	7.65	[c] 7.40	7.95	6.92	6.95
13	7.18	7.18	7.20	7.12	7.15	6.93	6.80	7.60	8.13	7.85	6.91	6.95
14	7.18	7.18	7.20	7.11	7.13	6.93	6.80	7.92	7.82	7.74	6.91	6.95
15	7.18	7.18	7.20	7.11	7.12	6.93	6.80	8.45	8.85	7.60	6.90	6.94
16	7.18	7.18	7.20	7.10	7.10	6.92	6.80	8.65	8.10	7.51	6.90	6.94
17	7.18	7.18	7.20	7.10	7.09	6.92	6.80	10.00	8.00	7.41	6.90	6.94
18	7.18	7.18	7.20	7.09	7.07	6.92	6.80	9.50	7.74	7.26	6.90	6.94
19	7.18	7.18	7.20	7.09	7.06	6.91	6.80	8.60	7.40	7.12	6.90	6.93
20	7.18	7.18	7.19	7.08	7.06	6.91	6.82	8.55	7.07	7.07	6.90	6.93
21	7.18	7.18	7.19	7.08	7.06	6.91	6.81	7.90	7.00	7.05	6.90	6.93
22	7.18	7.18	7.18	7.08	7.05	6.90	8.80	[b] 14.50	6.98	7.03	6.90	6.93
23	7.18	7.18	7.18	7.07	7.04	6.90	7.80	9.80	6.98	7.00	6.91	6.95
24	7.18	7.18	7.17	7.07	7.03	6.90	7.00	8.75	6.97	7.00	6.91	6.93
25	7.18	7.18	7.17	7.07	7.02	6.88	8.32	8.37	6.96	6.97	6.91	6.93
26	7.18	7.18	7.17	7.06	7.01	6.88	[a] 8.10	8.05	6.95	6.96	6.90	6.92
27	7.18	7.18	7.17	7.06	7.01	6.88	8.30	7.85	6.95	6.96	6.90	6.91
28	7.18	7.18	7.17	7.05	7.00	6.88	8.38	8.05	6.95	6.96	6.90	6.91
29	7.18	7.18	7.17	7.05	7.00	6.88	8.25	7.90	6.94	6.95	6.90	6.91
30	7.18	.....	7.16	7.05	6.99	6.87	9.15	7.85	6.93	6.95	6.90	6.91
31	7.18	.....	7.16	.....	6.99	.....	8.35	7.80	.....	6.95	.....	6.91

[a] On the night of July 26, gage read 11.3 feet.
[b] At 3 p. m., August 22, gage read 17.5 feet.
[c] On the night of September 12, gage read 11.3 feet.

Mean daily discharge, in second-feet, of Salt River at Roosevelt, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	223	217	212	195	124	105	64	675	600	158	175	168
2	224	217	212	191	123	100	62	590	540	154	173	169
3	224	217	213	182	123	95	60	720	520	154	171	168
4	224	217	219	178	123	93	58	1,615	460	150	166	170
5	224	216	219	174	122	93	56	960	435	146	166	168
6	223	224	219	170	122	90	54	445	415	146	166	171
7	223	220	220	166	122	90	54	480	415	555	166	176
8	223	220	220	158	122	87	54	590	385	610	166	234
9	223	215	221	153	118	84	52	445	385	285	166	215
10	222	215	221	150	296	84	52	1,065	385	235	166	194
11	222	215	221	152	140	83	52	590	385	230	166	182
12	222	215	226	149	178	83	50	410	385	690	166	174
13	222	214	227	146	158	80	50	380	1,020	595	163	174
14	222	214	227	145	150	80	51	590	700	530	163	174
15	221	214	228	146	146	80	52	1,120	1,970	450	160	170
16	221	214	228	143	139	77	52	1,355	990	400	160	170
17	221	213	228	143	136	76	52	3,600	880	350	160	170
18	221	213	229	139	128	76	52	2,645	630	280	160	170
19	220	213	229	139	124	74	52	1,295	385	220	160	166
20	220	213	225	136	124	74	57	1,235	215	210	160	166
21	220	213	224	136	124	74	55	590	186	211	160	166
22	220	212	218	136	122	71	1,550	14,700	178	207	160	166
23	219	212	217	132	120	71	515	3,200	178	198	164	174
24	219	212	210	132	119	71	105	1,500	174	201	164	166
25	219	212	209	131	117	66	960	1,320	170	193	164	166
26	219	211	207	128	115	66	765	940	166	192	160	162
27	218	211	206	127	116	66	960	740	166	195	161	158
28	218	211	204	124	115	66	1,065	940	166	194	162	158
29	218	211	203	124	113	66	910	780	162	187	163	158
30	218	.....	197	124	109	64	2,055	720	158	186	164	158
31	218	.....	195	.....	107	.....	1,010	660	.....	184	.....	158

Estimated monthly discharge of Salt River at Roosevelt, Ariz., for 1904.

[Drainage area, 5,756 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	224	218	221	13,590	0.038	0.044
February	224	211	215	12,370	.037	.040
March	229	195	217	13,340	.038	.044
April	195	124	148	8,807	.026	.029
May	296	107	132	8,116	.023	.027
June	105	64	79.5	4,731	.014	.016
July	2,055	50	356	21,890	.062	.071
August	14,700	380	1,513	93,030	.263	.303
September	1,970	158	460	27,370	.080	.089
October	690	146	281	17,280	.049	.056
November	175	160	164	9,759	.028	.031
December	234	158	172	10,580	.030	.035
The year	14,700	50	330	240,900	.057	.785

NOTE.—The above estimates have been prepared by interpolation based upon the discharge measurements and gage heights.

SALT RIVER AT M'DOWELL, ARIZ.

This station was established April 20, 1897, by J. B. Lippincott. It is located one-third mile above the junction of the Salt and Verde rivers, 30 miles northeast of Phoenix, 15 miles northeast of Mesa, and 1¾ miles above the Arizona canal diversion dam. There have been three gages in use at this station, as follows:

Gage No. 1, set by J. B. Lippincott April 20, 1897, was a 2 by 6 inch timber bolted to the rocks on the south bank of the river about one-fourth mile above the cable, from which discharge measurements are made. This gage, which has since been removed, was used until November 30, 1899, when the station was temporarily abandoned. The bench mark is a nail in a palo verde tree about 75 feet west of cable anchorage on the north bank. Its elevation is 17.33 feet above the zero of the gage.

In 1901 observations were resumed, and gage No. 2 was established by J. F. Appleby. It consists of a 2 by 6 inch timber fastened to a tree on the north bank of the river three-fourths mile above the cable. The zero of the gage is 1,323.54 feet above sea level, and its bench mark is a nail in a root of the willow tree to which the gage is fastened. Its elevation is 1,328.69 feet above sea level and 5.10 feet above the zero of the gage. On April 2, 1903, high water in the Verde River backed up the water on gage No. 2 and changed the cross section by depositing sand.

Gage No. 3 was established May 19, 1903, by W. W. Schlecht. It consists of a 1 by 6 inch stadia rod spiked to a 2 by 4 inch timber and fastened to a tree on the south bank 1⅛ miles above the cable. The water surface at this gage is about 15 feet higher than at the mouth of the Verde River, and the zero of the gage is 1,336.27 feet above sea level. Three bench marks have been established for gage No. 3: First, a nail in a mesquite stump 200 feet east of Peters's corral. Its elevation is 1,363.2 feet above sea level and 26.93 feet above the zero of the gage. Second, a nail in a root of a mesquite tree on the top of the bank 50 feet northwest of the northwest corner of Peters's corral and about 75 feet from the gage. Its elevation is 1,356 feet above sea level and 19.73 feet above the zero of the gage. Third, a nail in the willow tree to which the gage is attached. Its elevation is 1,344.27 feet above sea level and 8.00 feet above the zero of the gage. The observer is W. Richins, who also makes the discharge measurements.

Discharge measurements are made by means of a cable and car. The south end of the cable is anchored to the rocks and the north end is run over an 8 by 8 inch standard 21 feet high. During low water discharge measurements are made by wading about 1,000 feet upstream from the cable where a tag wire has been placed. The initial point for soundings is 120 feet south of the standard under the cable at the

north bank. The channel is straight for about 500 feet above and below the station. The current is swift. The right bank is about 3½ feet high at the water's edge and rises with a gradual slope for 400 feet. It is clean and subject to overflow. The left bank rises vertically for about 5 feet, when there is a small bench from which the rocks rise to a considerable height. The bank is clean and is not subject to overflow. The bed of the stream is composed of sand and is shifting, and it is necessary to make a large number of measurements in order to obtain an accurate estimate of the discharge.

The 1903 rating tables do not apply to the gage heights from April 2, 1903, until readings were begun on the new gage, May 19, 1903.

The observations at this station during 1904 have been made under the direction of C. G. Williams, district hydrographer.

Discharge measurements of Salt River at McDowell, Ariz., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.[a]	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
January 1	W. Richins	145	1.30	1.46	189
January 6	do	146	1.33	1.46	194
January 9	do	145	1.31	1.46	190
January 12	do	147	1.32	1.47	194
January 15	do	145	1.32	1.46	191
January 18	do	141	1.29	1.45	182
January 22	do	149	1.27	1.47	189
January 26	do	147	1.24	1.46	182
January 29	do	143	1.15	1.45	164
February 2	do	138	1.20	1.44	165
February 5	do	138	1.18	1.45	163
February 9	do	146	1.30	1.50	190
February 12	do	124	1.26	1.45	156
February 16	do	120	1.38	1.47	165
February 19	do	121	1.36	1.46	165
February 23	do	139	1.39	1.51	194
February 26	do	129	1.33	1.47	171
March 1	do	130	1.36	1.50	177
March 4	do	135	1.36	1.50	184
March 8	do	129	1.43	1.49	184
March 11	do	120	1.34	1.45	161
March 14	do	124	1.35	1.45	167
March 18	do	118	1.27	1.42	150
March 22	do	115	1.26	1.40	145
March 25	do	127	1.29	1.45	164
March 29	do	121	1.38	1.45	167

[a] Gage No. 3.

Discharge measurements of Salt River at McDowell, Ariz., in 1904—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 1	W. Richins	115	1.32	1.42	152
April 5	do	125	1.38	1.46	173
April 8	do	117	1.27	1.40	148
April 12	do	114	1.24	1.37	141
April 15 [a]	do	88	1.43	1.33	126
April 19 [a]	do	87	1.39	1.32	121
April 22 [a]	do	85	1.28	1.29	109
April 26 [a]	do	88	1.36	1.32	120
April 29 [a]	do	84	1.27	1.29	107
May 3 [a]	do	82	1.32	1.29	108
May 6 [a]	do	82	1.25	1.28	103
May 10 [a]	do	83	1.29	1.28	107
May 13 [a]	do	96	1.49	1.37	143
May 17 [a]	do	99	1.57	1.39	155
May 20 [a]	do	86	1.39	1.32	120
May 24 [a]	do	84	1.35	1.28	113
May 27 [a]	do	82	1.28	1.24	105
May 31 [a]	do	78	1.18	1.21	92
June 3 [a]	do	73	1.12	1.16	82
June 7 [a]	do	67	1.13	1.12	76
June 10 [a]	do	67	1.05	1.10	70
June 14 [a]	do	62	1.12	1.13	70
June 17 [a]	do	59	1.02	1.06	60
June 21 [a]	do	51	1.00	1.02	51
June 24 [a]	do	49	1.01	1.01	50
June 28 [a]	do	51	1.11	1.05	57
July 1 [a]	do	47	1.04	1.01	49
July 5 [a]	do	50	1.10	1.05	55
July 8 [a]	do	48	1.03	1.03	49
July 12 [a]	do	48	1.04	1.03	50
July 15 [a]	do	43	.91	.94	39
July 19 [a]	do	42	.95	.95	40
July 22 [a]	do	47	1.15	1.03	54
July 23	do	578	6.59	4.25	3,810
July 26	do	295	2.03	2.17	598
July 27	do	859	3.85	4.40	3,307
July 29	do	293	1.54	1.90	450
August 2	do	336	1.98	2.25	664
August 5	do	392	2.27	2.65	891

[a] Measurement made 1,000 feet upstream from cable station.

Discharge measurements of Salt River at McDowell, Ariz., in 1904—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
August 9	W. Richins	257	1.98	2.00	510
August 12	do	279	1.88	1.90	525
August 16	do	298	2.15	2.07	642
August 19	do	646	3.87	3.60	2,499
August 23	do	2,273	5.72	8.40	13,010
August 26	do	526	2.17	3.60	1,142
August 30	do	464	2.14	3.40	994
September 2	do	413	2.44	3.60	1,010
September 6	do	264	1.57	2.40	416
September 9	do	215	1.35	2.07	290
September 13	do	631	5.22	4.92	3,292
September 16	do	370	2.19	2.70	811
September 20	do	167	1.56	1.90	260
September 30	do	128	1.27	1.72	162
October 4	do	139	1.28	1.75	178
October 7	do	127	1.27	1.72	161
October 11	do	177	1.78	1.95	315
October 14	do	233	1.98	2.23	461
October 18	do	173	1.72	1.97	297
October 25	do	145	1.57	1.83	228
October 28	do	139	1.40	1.79	194
November 1	do	138	1.37	1.78	192
November 4	do	136	1.38	1.77	187
November 11	do	124	1.41	1.74	175
November 15	do	122	1.48	1.76	181
November 18	do	118	1.37	1.74	163
November 22	do	129	1.31	1.76	170
November 29	do	136	1.26	1.76	172
December 6	do	144	1.25	1.78	181
December 9	do	143	1.57	1.88	225
December 13	do	133	1.51	1.86	201
December 16	do	142	1.44	1.86	205
December 20	do	124	1.34	1.83	166
December 23	do	124	1.46	1.82	181
December 27	do	136	1.45	1.85	197
December 30	do	124	1.46	1.82	181

Mean daily gage height, in feet, of Salt River at McDowell, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.46	1.43	1.50	1.42	[a]1.28	1.18	1.02	2.65	3.63	1.72	1.78	1.76
2	1.47	1.43	1.50	1.43	1.28	1.17	1.03	2.17	3.45	[a]1.72	1.78	1.76
3	[a]1.46	1.43	1.50	[a]1.44	1.29	1.15	1.03	1.97	3.18	1.72	1.77	1.77
4	1.46	1.44	1.50	1.45	1.26	1.13	1.04	2.83	[a]3.05	1.76	1.77	[a]1.78
5	1.46	1.44	1.49	1.45	1.27	[a]1.13	1.03	2.83	2.92	1.71	1.76	1.79
6	1.46	1.47	1.49	1.44	1.27	1.13	1.04	2.02	2.35	1.76	1.77	1.79
7	1.45	[a]1.50	1.48	1.41	1.26	1.12	1.04	2.90	2.20	1.72	1.77	1.84
8	1.46	1.52	1.48	1.40	[a]1.26	1.10	1.02	2.90	2.15	2.21	1.77	1.88
9	1.46	1.50	1.47	1.39	1.27	1.11	1.02	1.87	2.06	2.10	1.77	1.88
10	[a]1.46	1.47	1.45	1.37	1.28	1.10	[a]1.02	1.88	2.00	2.08	1.76	1.88
11	1.46	1.47	1.45	1.38	1.37	1.09	1.02	2.32	[a]1.95	1.92	1.74	[a]1.87
12	1.47	1.45	1.42	1.36	1.33	1.10	1.03	2.00	1.90	2.13	1.74	1.86
13	[a]1.46	1.45	1.45	1.36	1.36	1.14	.95	1.90	4.85	2.31	[a]1.75	1.86
14	1.46	[a]1.46	1.45	1.34	1.36	1.13	.94	3.30	2.30	2.22	1.76	1.85
15	1.46	1.47	1.44	1.33	1.46	1.09	.94	2.07	2.90	2.13	1.76	1.84
16	1.45	1.47	1.44	1.33	1.40	1.06	.93	[d]2.50	2.75	[a]2.08	1.75	1.86
17	[a]1.45	1.47	1.43	1.33	1.40	1.06	.95	[d]3.15	2.40	2.03	1.74	1.85
18	1.45	1.46	1.42	1.32	1.34	1.05	.95	4.27	[a]2.26	1.96	1.74	[a]1.84
19	1.46	1.46	1.41	1.31	1.34	1.04	.95	[e]3.55	2.13	1.91	1.74	1.83
20	1.46	1.46	1.40	1.30	1.32	1.03	.95	3.35	1.90	1.88	[a]1.74	1.82
21	1.46	[a]1.46	1.40	1.28	1.31	1.02	.98	3.51	1.84	1.86	1.75	1.82
22	1.47	1.47	1.40	1.29	[a]1.30	1.02	1.04	3.37	1.78	1.85	1.76	1.81
23	1.47	1.50	1.41	1.30	1.29	1.01	[b]3.40	8.65	1.80	[a]1.84	1.76	1.82
24	[a]1.46	1.47	1.43	[a]1.31	1.28	1.01	1.58	[f]5.50	1.80	1.84	1.76	1.84
25	1.46	1.47	1.45	1.32	1.28	1.01	1.28	[f]4.15	1.77	1.82	1.76	[a]1.84
26	1.45	1.46	1.45	1.31	1.25	1.01	1.25	3.45	1.76	1.81	1.76	1.84
27	1.46	1.46	1.45	1.30	1.24	1.05	[c]3.70	3.27	1.75	1.79	1.76	1.84
28	1.45	[a]1.48	1.45	1.29	1.24	1.05	2.37	4.00	1.73	1.79	1.76	1.83
29	1.45	1.49	1.44	1.28	1.24	1.03	1.98	3.62	1.73	1.79	1.76	1.82
30	1.45	.....	1.43	1.27	1.22	1.02	4.85	3.35	1.72	1.80	1.76	1.82
31	[a]1.44	.....	1.42	.....	1.20	.....	2.60	3.70	.....	1.78	.....	1.81

[a] Interpolated gage height.
[b] Freshet July 23—gage height 9 a. m., 4.5 feet; 11 a. m., 4 feet.
[c] July 27, gage height 11 a. m., 8 feet; 12 m., 5.2 feet; 2 p. m., 4 feet.
[d] Night of Aug. 16–17, gage height 8.7 feet.
[e] Aug. 19, 12 m., the gage read 4.4 feet.
[f] Night Aug. 24–25, gage height 9.5 feet.

NOTE.—All readings from gage No. 3.

Mean daily discharge, in second-feet, of Salt River at McDowell, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	189	161	177	152	105	85	51	1,050	1,070	162	188	171
2	193	162	179	157	105	84	52	600	1,010	162	190	170
3	191	160	182	162	108	79	52	415	760	161	186	176
4	192	161	184	168	99	76	53	1,115	700	184	187	181
5	193	160	182	170	101	77	51	1,070	640	154	181	187
6	194	172	182	165	100	77	52	410	395	184	187	186
7	190	185	180	153	98	76	52	1,240	335	161	187	210
8	191	194	180	148	99	71	47	1,310	320	460	187	230
9	190	190	174	145	103	73	48	420	287	397	187	225
10	190	174	165	140	107	70	48	450	267	389	181	222
11	190	168	161	144	137	66	48	840	250	297	169	213
12	194	156	153	138	128	66	50	600	236	415	169	204
13	191	157	165	137	140	74	39	520	3,200	515	175	201
14	191	160	167	130	142	70	38	2,060	510	455	181	196
15	191	164	162	126	174	63	39	645	970	400	181	192
16	186	165	160	126	157	58	38	1,040	850	368	172	205
17	184	166	155	125	158	60	40	1,820	575	337	163	199
18	182	164	150	121	135	58	40	3,670	485	293	160	193
19	185	165	147	118	131	55	40	2,420	400	265	161	187
20	186	168	145	114	120	53	40	2,120	260	249	161	181
21	186	172	145	107	118	51	45	2,360	225	239	167	181
22	189	178	145	109	116	51	56	2,140	190	235	173	175
23	188	191	149	113	115	50	2,340	13,700	203	230	173	181
24	184	178	157	116	113	50	320	2,200	204	232	173	193
25	183	174	164	120	114	50	130	1,640	188	222	173	192
26	179	168	165	117	107	50	100	1,030	182	213	172	192
27	177	167	165	113	105	57	2,150	900	177	198	172	191
28	169	172	166	108	104	57	720	1,500	166	194	172	186
29	164	175	164	104	103	53	510	1,150	167	194	172	180
30	165	.....	159	102	96	51	4,650	994	162	200	172	181
31	163	.....	154	.....	89	.....	1,020	1,170	.....	188	.....	175

Estimated monthly discharge of Salt River at McDowell, Ariz., for 1904.

[Drainage area, 6,260 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	194	163	185	11,380	0.030	0.035
February	194	156	170	9,779	.027	.029
March	184	145	164	10,080	.026	.030
April	170	102	132	7,855	.021	.023
May	174	89	117	7,194	.019	.022
June	85	50	63.7	3,790	.010	.011
July	4,650	38	418	25,700	.067	.077
August	13,700	410	1,697	104,300	.271	.312
September	3,200	162	513	30,530	.082	.091
October	515	154	269	16,540	.043	.050
November	190	160	176	10,470	.028	.031
December	230	170	192	11,810	.031	.036
The year	13,700	38	341	249,400	.055	.747

NOTE.—The above estimates have been prepared by interpolation based upon the discharge measurements and gage heights.

TONTO CREEK AT ROOSEVELT, ARIZ.

This station, established April 1, 1901, by H. G. Heisler, is located at the town of Roosevelt and about 12 miles west of Livingston. This station was called Tonto Creek near Livingston in reports previous to 1903.

The gage, a vertical rod fastened to a cliff of cemented gravel on the left bank, was about 3,500 feet above the mouth of the creek. Measurements were made by wading with meter during low water and by means of floats over a course of 25 feet during floods. The channel is straight for about 300 feet above and 1,000 feet below the station. The current above the station is swift at high stages and swift below the station. The right bank is high, and is not subject to overflow. The left bank is low, wooded, and liable to overflow. The bed of the stream is composed of sand and gravel and is shifting. This station was abandoned the latter part of August, 1904, owing to the destruction of the gage by a flood. All the water is measured at the Roosevelt station on Salt River, immediately below.

The observations at this station during 1904 have been made under the direction of C. G. Williams, district hydrographer.

Mean daily gage height, in feet, of Tonto Creek at Roosevelt, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	3.25	3.25	3.25	3.25	3.25	3.25	3.25	4.25
2	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.45
3	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.55
4	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.90
5	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.32
6	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.30
7	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.30
8	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.30
9	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.40
10	3.25	3.25	3.25	3.25	3.25	3.25	3.25	4.37
11	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.90
12	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.70
13	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.70
14	3.25	3.25	3.25	3.25	3.25	3.25	3.25	4.15
15	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.77
16	3.25	3.25	3.25	3.25	3.25	3.25	3.25	4.82
17	3.25	3.25	3.25	3.25	3.25	3.25	3.25	5.15
18	3.25	3.25	3.25	3.25	3.25	3.25	3.25	5.40
19	3.25	3.25	3.25	3.25	3.25	3.25	3.25	5.50
20	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.90
21	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.75
22	3.25	3.25	3.25	3.25	3.25	3.25	5.37	4.25
23	3.25	3.25	3.25	3.25	3.25	3.25	4.25	10.10
24	3.25	3.25	3.25	3.25	3.25	3.25	3.45	4.25
25	3.25	3.25	3.25	3.25	3.25	3.25	5.47	3.60
26	3.25	3.25	3.25	3.25	3.25	3.25	5.29	3.47
27	3.25	3.25	3.25	3.25	3.25	3.25	5.85	3.45
28	3.25	3.25	3.25	3.25	3.25	3.25	5.62	3.75
29	3.25	3.25	3.25	3.25	3.25	3.25	5.75	3.50
30	3.25	.....	3.25	3.25	3.25	3.25	6.05	3.50
31	3.25	.....	3.25	.....	3.25	.....	6.20	3.50

VERDE RIVER AT McDOWELL, ARIZ.

This station was established April 20, 1897, by J. B. Lippincott. It is located 30 miles northeast of Phoenix, 15 miles northeast of Mesa, 2⅛ miles above the Arizona Canal diversion dam, and three-fourths of a mile above the mouth of the river. Three gages have been in use at this station, as follows:

Gage No. 1 was established April 20, 1897, by J. B. Lippincott. It consisted of a vertical rod attached to a large cottonwood tree on the east bank about 60 feet below the cable. Readings were taken from this gage until November 11, 1899, when the station was temporarily abandoned. The bench mark is a point on a cats-claw (Acacia) tree about 100 feet southeast of the gage. Its elevation is 27.02 feet above the zero of the gage.

Gage No. 2 was established in January, 1901, by H. G. Heisler, and observations were resumed. It is an inclined 2 by 4 inch timber, fastened to the rocks on the west bank about 500 feet above the cable, the

zero of the gage being 1,325.4 feet above sea level. Three bench marks have been established for gage No. 2. First, a nail in a mesquite tree about 6 feet below the cable anchorage on the east bank; its elevation is 1,345.5 feet above sea level, and 20.10 feet above the zero of the gage. Second, a nail in the cable standard at the east bank; its elevation is 1,341.3 feet above sea level, and 15.90 feet above the zero of the gage. Third, a mark on rock at the gage; its elevation is 1,330.4 feet above sea level, and 5.00 feet above the zero of the gage.

On account of water piling up at gage No. 2 during flood, gage No. 3 was established May 16, 1904, by C. G. Williams. It is a vertical 1¼ by 6 inch rod spiked to a 2 by 6 inch timber fastened to a willow tree on the east bank about one-half mile above the cable. The zero of the gage is 1,339.26 feet above sea level. Two bench marks have been established for gage No. 3. First, a nail in a large cottonwood tree on the top of the east bank near the gage; its elevation is 1,354.11 feet above sea level, and 14.85 feet above the zero of the gage. Second, a nail in the willow tree to which the gage is attached; its elevation is 1,347.26 feet above sea level, and 8.00 feet above the zero of the gage. The observer is W. Richins, who also makes the discharge measurements.

Discharge measurements are made by means of a cable, car, and tagged wire. At low water the channel is oblique to the gaging section and measurements are made by wading at a point 400 feet above the cable. The channel is straight for a distance of 300 feet above and below the station, and has a width at low water of 100 feet and at high water of 450 feet. The current is swift. The right bank is high, rocky, clean, and is not subject to overflow; the left bank is low, clean, and is subject to overflow. The bed of the stream is composed of sand and is shifting.

The observations at this station during 1904 have been made under the direction of C. G. Williams, district hydrographer.

Discharge measurements of Verde River at McDowell, Ariz., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
January 1	W. Richins	119	1.97	2.19	235
January 6	do	119	2.01	2.19	239
January 9	do	128	1.97	2.20	252
January 12	do	125	2.00	2.20	250
January 15	do	116	1.94	2.15	225
January 18	do	115	1.98	2.13	228
January 22	do	124	2.05	2.13	254
January 26	do	115	2.01	2.12	231

Discharge measurements of Verde River at McDowell, Ariz., in 1904—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
January 29	W. Richins	112	2.01	2.10	225
February 2	do	112	2.03	2.10	227
February 5	do	117	2.05	2.10	240
February 9	do	112	2.11	2.10	236
February 12	do	105	2.28	2.06	239
February 16	do	102	2.16	2.00	220
February 19	do	100	2.22	2.00	222
February 23	do	97	2.24	1.99	217
February 26	do	93	2.27	1.95	211
March 1	do	94	2.34	1.92	220
March 4	do	84	2.19	1.85	184
March 8 [a]	do	85	1.58	1.80	134
March 11 [a]	do	90	1.74	1.82	157
March 14 [a]	do	91	1.80	1.87	164
March 18 [a]	do	100	1.97	1.92	197
March 22 [a]	do	99	2.07	1.92	205
March 25 [a]	do	96	2.31	1.99	221
March 29 [a]	do	95	2.02	1.88	192
April 1 [a]	do	89	1.97	1.83	175
April 5 [a]	do	84	1.81	1.79	152
April 8 [a]	do	84	1.67	1.74	140
April 12 [a]	do	75	1.53	1.65	115
April 15 [a]	do	75	1.45	1.64	109
April 19 [a]	do	74	1.31	1.60	97
April 22 [a]	do	75	1.37	1.63	103
April 26 [a]	do	77	1.32	1.62	102
April 29 [a]	do	75	1.28	1.59	96
May 3 [a]	do	76	1.24	1.58	94
May 6 [a]	do	77	1.38	1.62	106
May 10 [a]	do	71	1.31	1.52	93
May 13 [a]	do	71	1.42	1.53	101
May 17 [a]	do	99	2.12	1.82	210
May 20 [a]	do	75	1.80	1.49	135
May 24 [a]	do	70	1.50	1.36	105
May 27 [a]	do	66	1.38	1.31	91
May 31 [a]	do	66	1.37	1.27	90
June 3 [a]	do	63	1.29	1.23	81
June 7 [a]	do	62	1.29	1.21	80
June 10 [a]	do	62	1.29	1.21	80

[a] Measurement made at temporary station 400 feet upstream from cable station.

Discharge measurements of Verde River at McDowell, Ariz., in 1904—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 14 [a]	W. Richins	56	1.16	1.16	65
June 17 [a]	do	55	1.13	1.14	62
June 21 [a]	do	53	.96	1.08	51
June 24 [a]	do	50	.86	1.02	43
June 28 [a]	do	52	.98	1.06	51
July 1 [a]	do	49	.96	1.02	47
July 5 [a]	do	48	.92	1.01	44
July 8 [a]	do	49	.94	1.02	46
July 12 [a]	do	50	.94	1.02	47
July 15 [a]	do	46	.87	.99	40
July 19 [a]	do	42	.76	.92	32
July 22 [b]	do	102	1.38	.50	141
July 26 [b]	do	347	2.89	2.02	1,003
July 27 [b]	do	1,233	5.23	5.30	6,450
July 29 [b]	do	449	2.98	2.33	1,340
July 31 [b]	do	1,178	5.15	5.42	6,070
August 2 [b]	do	409	2.77	2.32	1,133
August 5 [b]	do	383	2.94	2.10	1,125
August 9 [b]	do	319	2.59	1.75	826
August 12 [b]	do	519	3.88	2.83	2,014
August 16 [b]	do	276	3.05	1.55	841
August 19 [b]	do	370	3.36	1.95	1,244
August 23 [b]	do	815	6.36	5.10	5,184
August 26 [b]	do	377	3.55	2.55	1,340
August 30 [b]	do	435	3.89	2.50	1,693
September 2 [b]	do	319	2.94	1.95	938
September 6 [b]	do	207	2.47	1.50	513
September 9 [b]	do	160	2.24	1.05	359
September 13 [b]	do	339	3.27	1.95	1,109
September 16 [b]	do	224	2.26	1.50	506
September 20 [b]	do	146	2.10	1.15	307
September 30 [b]	do	87	2.03	.68	177
October 4 [b]	do	100	2.00	.72	200
October 7 [b]	do	94	1.87	.68	176
October 11 [b]	do	96	2.10	.75	202
October 14 [b]	do	94	2.15	.72	202
October 18 [b]	do	85	1.94	.70	165
October 25 [b]	do	97	2.08	.74	202
October 28 [b]	do	91	2.13	.75	194
November 1 [b]	do	93	2.07	.78	193
November 4 [b]	do	101	2.04	.79	206
November 11 [b]	do	95	2.11	.84	200
November 15 [b]	do	105	2.01	.87	211
November 18 [b]	do	104	2.05	.90	213
November 29 [b]	do	104	2.09	.95	217
November 29 [b]	do	108	1.99	.94	215

[a] Measurement made at temporary station 400 feet upstream from cable station.
[b] Gage heights from July 21 to December 31 taken from gage No. 3. Measurement made at cable station. All other gage heights from gage No. 2.

Discharge measurements of Verde River at McDowell, Ariz., in 1904—Continued.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
December 6 [a]	W. Richins	113	2.05	.98	232
December 9 [a]	do	121	2.34	1.05	283
December 13 [a]	do	114	2.25	1.02	256
December 16 [a]	do	106	2.08	1.03	221
December 20 [a]	do	116	2.15	1.06	249
December 23 [a]	do	118	2.22	1.07	262
December 27 [a]	do	111	2.06	1.04	229
December 30 [a]	do	111	2.17	1.08	241

[a] Gage heights from July 21 to December 31 taken from gage No. 3. Measurement made at cable station. All other gage heights from gage No. 2.

Mean daily gage height, in feet, of Verde River at McDowell, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.19	2.10	1.92	1.82	[a] 1.57	1.25	1.02	2.95	2.07	0.68	0.78	0.95
2	2.19	2.10	1.92	1.81	1.57	1.24	1.02	2.32	1.90	[a] .68	.79	.96
3	[a] 2.19	2.10	1.89	[a] 1.80	1.58	1.23	[a] 1.01	2.10	1.75	.72	.78	.96
4	2.19	2.10	1.84	1.80	1.62	1.22	1.00	2.18	[a] 1.71	.75	.79	[a] .97
5	2.19	2.09	1.82	1.78	1.62	[a] 1.22	1.01	2.18	1.67	.68	.79	.98
6	2.19	2.12	1.82	1.75	1.62	1.21	1.00	[c] 1.90	1.37	.66	.84	.99
7	2.18	[a] 2.11	1.81	1.74	1.60	1.20	1.01	[c] 1.80	1.19	.68	.84	1.00
8	2.19	2.10	1.80	1.73	[a] 1.57	1.21	1.01	1.55	1.15	.66	.84	1.04
9	2.20	2.10	1.79	1.72	1.54	1.21	1.02	1.77	1.05	[a] .67	.85	1.05
10	[a] 2.20	2.10	1.80	[a] 1.70	1.52	1.20	[a] 1.02	1.45	1.05	.73	.84	1.05
11	2.20	2.08	1.82	1.67	1.51	1.20	1.01	1.82	[a] 1.05	.75	.84	[a] 1.04
12	2.19	2.06	1.83	1.64	1.62	1.19	1.02	2.85	1.05	.73	.83	1.02
13	[a] 2.17	2.05	[a] 1.85	1.65	1.52	1.17	1.00	1.90	2.80	.72	[a] .85	1.02
14	2.15	[a] 2.03	1.87	1.63	2.28	1.16	.99	2.22	1.80	.71	.87	1.04
15	2.15	2.01	1.88	1.63	2.23	1.14	.97	2.05	1.65	.71	.88	1.03
16	2.13	2.00	1.91	1.61	1.91	1.13	.97	1.65	1.50	[a] .72	.90	1.03
17	[a] 2.13	2.00	1.92	[a] 1.60	1.79	1.13	[a] .95	3.80	1.40	.72	.90	1.03
18	2.13	1.99	1.92	1.59	1.67	1.11	.93	2.42	[a] 1.28	.70	.90	[a] 1.04
19	2.13	2.00	1.91	1.60	1.56	1.10	.92	2.43	1.17	.68	.91	1.05
20	2.13	2.01	[a] 1.91	1.62	1.48	[a] 1.08	.92	[c] 2.30	1.15	.68	[a] .92	1.06
21	2.13	[a] 2.00	1.91	1.61	1.42	1.08	[b] 1.45	1.90	1.09	.69	.93	1.07
22	2.13	2.00	1.92	1.63	[a] 1.40	1.06	.45	2.85	.97	.72	.95	1.06
23	2.12	1.99	1.93	1.63	1.39	1.04	1.15	4.60	.88	[a] .72	.94	1.06
24	[a] 2.12	1.97	1.98	[a] 1.62	1.36	1.02	.56	4.10	.80	.73	.93	1.07
25	2.13	1.97	1.99	1.60	1.35	1.01	.64	3.17	.78	.74	.94	[a] 1.06
26	2.12	1.94	1.95	1.62	1.33	[a] 1.02	2.02	2.65	.77	.75	.92	1.04
27	2.10	1.93	[a] 1.92	1.64	1.30	1.03	4.85	2.42	.73	.75	.93	1.04
28	2.10	[a] 1.92	1.89	1.63	1.30	1.06	2.20	[c] 3.80	.72	.75	.94	1.06
29	2.10	1.92	1.87	1.59	1.31	1.04	2.35	2.40	.69	.75	.94	1.07
30	2.09	.....	1.86	1.57	1.28	1.01	4.85	2.45	.68	[a] .76	.94	1.08
31	[a] 2.10	.....	1.85	.....	1.26	.....	5.40	2.15	.....	.78	.....	1.08

[a] Interpolated gage height.
[b] Freshet July 21. Gage height 7 a. m., 2 feet; 12 m., 2.40 feet; 6 p. m., 0.9 feet.
[c] Gage height August 6, 7, 20, and 28 estimated.

NOTE.—Gage height January 1 to July 20 from gage No. 2; July 21 to December 31 from gage No. 3.

Mean daily discharge, in second-feet, of Verde River at McDowell, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	235	226	220	173	92	83	45	1,850	1,090	181	193	119
2	236	227	214	167	92	81	45	1,133	890	184	199	222
3	237	231	200	161	94	79	43	975	740	197	200	224
4	237	236	182	158	104	78	42	1,135	690	207	206	227
5	238	237	168	150	105	78	43	1,210	645	186	203	231
6	239	244	158	142	106	76	42	930	430	176	213	234
7	240	240	146	140	103	74	43	850	365	176	210	248
8	246	237	134	138	99	76	43	659	375	174	208	269
9	252	236	137	134	95	76	45	840	359	178	207	283
10	251	241	146	129	93	74	45	565	365	195	202	278
11	251	240	157	120	92	74	43	840	375	202	200	271
12	247	239	158	113	118	72	45	2,050	385	200	200	261
13	238	236	161	114	99	69	42	960	2,210	200	206	256
14	229	230	164	108	322	67	41	1,370	880	200	212	249
15	225	224	172	107	310	63	38	1,270	670	192	216	234
16	223	220	184	102	233	62	38	935	506	186	218	221
17	226	221	192	99	205	62	36	4,150	440	177	215	226
18	228	219	197	96	166	59	34	1,850	375	165	213	234
19	234	222	197	97	149	57	32	1,850	315	165	213	242
20	241	224	198	101	132	54	32	1,430	307	168	214	249
21	248	222	201	99	118	54	530	850	285	175	214	255
22	254	220	205	103	114	51	135	1,780	243	186	217	256
23	246	217	207	104	112	48	360	4,500	215	190	215	260
24	242	214	219	101	105	45	150	3,650	193	196	213	254
25	239	214	221	98	103	43	170	2,150	190	202	215	246
26	231	208	212	102	99	45	1,003	1,460	190	201	210	235
27	226	210	203	107	93	46	5,600	1,280	183	198	212	229
28	226	212	195	105	93	51	1,200	3,525	183	194	215	235
29	225	216	190	96	95	48	1,360	1,460	177	192	215	238
30	224	.....	186	92	89	43	5,250	1,630	177	192	215	241
31	226	.....	181	.....	85	.....	6,030	1,230	.....	195	.....	241

Estimated monthly discharge of Verde River at McDowell, Ariz., for 1904.

[Drainage area, 6,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	254	223	237	14,570	0.040	0.046
February	244	208	226	13,000	.038	.04[illegible]
March	221	134	184	11,310	.031	.036
April	173	92	119	7,081	.020	.022
May	322	85	126	7,747	.021	.024
June	83	43	62.9	3,743	.010	.011
July	6,030	32	729	44,820	.122	.141
August	4,500	565	1,624	99,860	.271	.312
September	2,210	177	482	28,680	.080	.089
October	207	165	188	11,560	.031	.036
November	218	193	210	12,500	.035	.039
December	283	119	241	14,820	.040	.046
The year	6,030	32	369	269,700	.062	.843

NOTE.—The above estimates have been prepared by interpolation based upon the discharge measurements and gage heights.

MISCELLANEOUS DISCHARGE MEASUREMENTS IN THE COLORADO RIVER DRAINAGE BASIN.

The following miscellaneous measurements were made in the Colorado River drainage basin in 1904:

Miscellaneous discharge measurements in Colorado River drainage basin.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
				Sec.-feet.
Aug. 30	Oro McDermith	Chimney Creek	Yampa, Colo	13
June 18	do	do	do	16
June 23	do	Elkhead Creek	Craig, Colo	59
May 1	do	do	Hayden, Colo	822
Apr. 30	do	Fortification Creek	Craig, Colo	219
Aug. 29	do	Grand	Wolcott, Colo	1,693
Sept. 1	W. A. Lamb	Grand Lake	East Inlet to	99
Oct. 5	do	do	do	16
Aug. 16	do	do	do	42
Sept. 2	do	do	North Inlet to	93
Oct. 5	do	do	do	22
Aug. 16	do	do	North Outlet to	45
Aug. 24	Oro McDermith	Hunt Creek	Yampa, Colo	13
June 17	do	do	do	43
Apr. 29	do	Marapos Creek	Hamilton, Colo	146
Aug. 29	do	Rock Creek	McCoy, Colo	37
Nov. 4	R. C. Prewitt	San Juan River	Farmington, N. Mex	1,064
Nov. 25	do	do	do	514
Dec. 10	do	do	do	427
July 25	Oro McDermith	Soda Creek	Steamboat, Colo	11
May 5	W. A. Lamb	do	Steamboat Springs, Colo	86
May 5	do	Spring Creek	do	36
June 21	Oro McDermith	do	Steamboat, Colo	41
June 20	do	Walton Creek	Sidney, Colo	275
July 25	do	do	Steamboat, Colo	3.7
Apr. 13	do	White River	Whiteriver, Colo	596
July 14	do	do	do	568
Aug. 25	do	Yampa River	Yampa, Colo	22
June 18	do	do	do	134

Discharge measurement of La Plata canal near Hesperus, Colo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 14	M. C. Hinderlider	8	4.8	0.94	0.85	4.5

Waste measurements in Colorado River drainage basin in 1904.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
				Sec.-feet.
Oct. 10	W. V. Hardy and S. M. Smith.	New River	Brawley, Cal	208
Oct. 11	do	Alamo channel	Rockwood, Cal	43
		Canal No. 5	Bernice, Cal	([a])
Oct. 18	do	New River	Brawley, Cal	380
Oct. 18	do	Alamo channel	Rockwood, Cal	45
Oct. 19	do	Canal No. 5	Bernice, Cal	77
				502
Oct. 31	do	New River	Brawley, Cal	381
Nov. 1	do	Alamo channel	Rockwood, Cal	59
Nov. 1	do	Canal No. 5	Bernice, Cal	58
				498
Nov. 9	W. V. Hardy	New River	Brawley, Cal	318
Nov. 9	do	Alamo channel	Rockwood, Cal	49
Nov. 9	do	Canal No. 5	Bernice, Cal	0
				367
Nov. 16	do	New River	Brawley, Cal	270
Nov. 15	do	Alamo channel	Rockwood, Cal	117
Nov. 15	do	Canal No. 5	Bernice, Cal	1
				388
Nov. 24	do	New River	Brawley, Cal	311
Nov. 22	do	Alamo channel	Rockwood, Cal	81
Nov. 22	do	Canal No. 5	Bernice, Cal	3
				395
Nov. 30	do	New River	Brawley, Cal	231
Nov. 30	do	Alamo channel	Rockwood, Cal	73
Nov. 30	do	Canal No. 5	Bernice, Cal	0
				304
Dec. 6	do	New River	Brawley, Cal	257
Dec. 6	do	Alamo channel	Rockwood, Cal	46
Dec. 6	do	Canal No. 5	Bernice, Cal	0
				303

[a] No measurement made.

Waste measurements in Colorado River drainage basin in 1904—Continued.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
				Sec.-feet.
Dec. 13	W. V. Hardy	New River	Brawley, Cal	301
Dec. 13	do	Alamo channel	Rockwood, Cal	52
Dec. 13	do	Canal No. 5	Bernice, Cal	0
				353
Dec. 24	do	New River	Brawley, Cal	254
Dec. 24	do	Alamo channel	Rockwood, Cal	39
Dec. 24	do	Canal No. 5	Bernice, Cal	0
				293

Miscellaneous discharge measurements in Colorado River drainage basin in 1903 and 1904.

Date.	Hydrographer.	Stream.	Locality.	Gage height.	Discharge.
1903.				*Feet.*	*Sec.-ft.*
Mar. 4	W. D. Smith	Colorado Valley Pumping and Irrigation Co.'s canal.	At heading		20
May 9	do	do	do		51
June 17	do	do	do		46
June 19	do	do	do		44
June 30	do	do	do		48
July 1	do	do	do		46
July 18	do	do	do		42
July 29	do	do	do		50
Aug. 8	L. M. Barnes	do	do		51
Sept. 14	W. D. Smith	do	do		42
Oct. 19	do	do	do		33
Nov. 17	do	do	do		34
Dec. 18	do	do	do		31
1904.					
Feb. 22	W. D. Smith and S. M. Woodward.	Colorado Valley Pumping and Irrigation Co.'s canal.	At heading	1.11	19.8
Feb. 22	do	do	do		9.9
Feb. 23	do	do	do	.89	11.5
Feb. 23	do	do	do		11.8
Feb. 23	do	do	do		11.8
Feb. 23	do	do	do		11.2
1903.					
May 20	W. D. Smith	Ludy canal	At heading		60

Miscellaneous discharge measurements in Colorado River drainage basin in 1903 and 1904—Continued.

Date.	Hydrographer.	Stream.	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
1903.					
June 5	W. D. Smith	Ludy canal	At heading		79
June 23	do	do	do		38
July 21	do	do	do		71
Sept. 11	do	do	do		63
Oct. 9	do	do	do		25
Oct. 24	do	do	do		66
Nov. 20	do	do	do		24
Dec. 7	do	do	do		37
Dec. 21	do	do	do		14
1904.					
May 8	W. D. Smith	Ludy canal	At heading		50
May 24	do	do	do		59
June 4	do	do	do		158
June 16	do	do	do		92
July 27	do	do	do		185
1903.					
June 5	W. D. Smith	Farmers' canal	At heading		25
June 23	do	do	do		38
1904.					
May 8	W. D. Smith	Farmers' canal	At heading		63
May 24	do	do	do		97
June 4	do	do	do		56
June 16	do	do	do		35
July 27	do	do	do		47
Aug. 9	S. M. Smith	do	do		70
1903.					
June 20	W. D. Smith	Rose flume	At Rose ranch[a]	0.96	10
June 20	do	do	do	.91	8.5
June 20	do	do	do	.86	8
June 20	do	do	do	.97	10
Oct. 1	do	do	do	.68	7
Oct. 1	do	do	do	.68	7
1904.					
Aug. 4	W. D. Smith	Imperial canal	At junction with Carter River, Mexico.		309
Aug. 3	do	Main channel, Imperial canal.	Below Bests' camp, Mexico.		525

[a] These measurements were made to rate flume for ascertaining duty of water on 12-a[illegible] alfalfa field

Miscellaneous discharge measurements in Colorado River drainage basin in 1903 and 1904—Continued.

Date.	Hydrographer.	Stream.	Locality.	Gage height.	Discharge.
1904.				*Feet.*	*Sec.-ft.*
Aug. 3	W. D. Smith	Padrone River diversion (waste from Imperial canal).	At Bests' camp, Mexico.	.....	609
Oct. 12	S. M. Smith	New River	At Calexico, Cal.	.....	154
Nov. 2	W. V. Hardy and S. M. Smith.	do	do	.....	52
Nov. 10	S. M. Smith	do	do	.....	28
Nov. 17	W. V. Hardy	do	do	.....	24
Nov. 23	do	do	do	.....	20
Dec. 1	do	do	do	.....	18.6
Dec. 7	do	do	do	.....	16.7
Dec. 14	do	do	do	.....	22
Dec. 21	do	do	do	.....	10.2

Creeks and canals in northeastern Utah.

Date.	Hydrographer.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1904.				*Feet.*	*Sq. feet.*	*Ft. p. s.*	*Feet.*	*Sec.-ft.*
Mar. 15	H. S. Reed	Pole Creek	Above mouth	12	6.75	1.10	.....	7.4
May 27	do	do	do	17	18.5	3.41	.....	63
Aug. 29	do	do	do	12	8.1	1.19	.....	9.7
May 24	do	Dry Fork	do	29	50	6.16	.....	308
July 14	do	Dry Gulch Creek	do	5.5	2	.90	.....	1.8
July 14	do	Government canal below post.	Below headgate.	6.5	4.6	1.91	.....	8.7
May 27	do	Farm Creek	Above mouth	6.5	4.3	3.51	.....	15
May 16	do	Stream at lake[a] (tributary).	West Fork of Lake Creek.	12.5	12	3.09	.....	37
June 29	do	do	do	12	9	2.31	.....	21
June 28	do	Lake Creek	Below junction.	72	140	5.06	1.75	708

[a] This creek has good slope and could be used for waterpower.

GREAT BASIN DRAINAGE.

The Great Basin comprises an immense area of interior drainage in which the streams do not discharge into the ocean. This area is not one single drainage basin, but rather consists of a number of basins, some of which are connected while others are closed; the outer boundary of all, however, is at such an elevation that the region as a whole has no outlet. The Great Basin includes almost all of Nevada, western Utah, and contiguous parts of Idaho, Oregon, and California. It is rudely triangular in outline, resembling an isosceles triangle, the apex of the longer dimension extending almost to the Gulf of California.

This inclosed area is approximately 800 miles long from north to south, 500 miles broad in the widest part, and it has been estimated to include 208,500 square miles. The Great Basin is bordered on the west by the Sierra Nevada, on the north by the Columbia plateaus, and on the east by the Rocky Mountains and the Colorado plateaus. The southern extremity lies in the little-known area west of Colorado River and north of the Gulf of California.

Topographically this interior drainage area in general is characterized by isolated narrow mountain ranges trending north and south, which are separated by broad valleys. In altitude the Great Basin varies considerably. The valleys in the southern part are low, Death Valley being below sea level, while in the north the valleys have a general elevation of from 4,000 to 5,000 feet. The intervening highlands often rise several thousand feet above their bases, and some of the peaks of the bordering mountains attain elevations of 13,000 feet.

Upper branches of the intermontane valleys extend into the interior ranges as narrow drainage ways that are dry during most of the year, while the drainage from the high mountains on the east and west borders of the Great Basin passes through deep canyons into the broad valleys, where the perennial streams maintain lakes. Among these are Great Salt, Utah, and Sevier lakes in the eastern part, and Pyramid, Winnemucca, Honey, Walker, Mono, and Owens lakes in the western part of the Great Basin. With the exception of Utah Lake, which discharges by Jordan River into Great Salt Lake, the character of the others, in consequence of the concentration of salts due to evaporation, is saline. Shallow, temporary bodies of water accumulate in some of the broad intermontane valleys during the wet season, but completely evaporate during the summer, leaving broad, muddy plains called playas. Bear Lake, in the mountains of the eastern border, and Lake Tahoe, in the Sierras, near the western border of the basin, are large bodies of fresh water that drain, respectively, to Great Salt and Pyramid lakes.

Geologically the Great Basin is well known as the type region of the "Basin Range structure." Many of the isolated narrow mountain ranges that trend north and south are steep on one side, exposing cross sections of the rocks, and sloping on the other, conforming with the dip of the strata. These ranges have been uplifted by movements of the earth's crust, whereby it has been broken into tilted blocks. The greatest displacements of the Great Basin are associated with its eastern and western borders, the Wasatch Mountains and Sierra Nevada having been uplifted many thousand feet. The mountains of the Great Basin are commonly composed of Paleozoic strata, often modified by vulcanism, and the products of weathering and disintegration of these rocks have accumulated in the broad intervening valleys, which are strewn to great depths with unconsolidated débris.

The climate of the Great Basin is extremely arid, and excepting the few favored spots where irrigation flourishes, the region in general is desert. Over the larger part of the area the annual precipitation is less than 10 inches, the main amount occurring as snowfall on the high mountains. Temperature varies considerably consequent to the large extent of the area and to the differences in elevation. Over most of the region the heat of summer days is intense, but the diurnal variation is considerable. Evaporation is enormous. From the surface of water in the vicinity of Salt Lake City it has been found to amount to about 60 inches a year, and over the larger part of the Great Basin is considerably greater, amounting in places possibly to 150 inches.

An arid climate, however, has not always prevailed in this region. In late geologic time (early Quarternary) the bordering high mountains supported glaciers, and enormous lakes (the old shore lines of which are now plainly marked on the sides of many valleys) accumulated in the Great Basin. The two largest of these lakes have been named after early explorers. Lake Bonneville occupied a considerable part of western Utah, its shrunken remnants being represented by Sevier, Utah, and Great Salt lakes; and Lake Lahontan covered an immense area in western Nevada.

The chief rivers of the Great Basin rise in the mountains, which form its eastern and western borders, and receive their principal supply from melting snow. The nature of the discharge is characteristic, the maximum commonly occurs in late spring or early summer, after which the flow decreases to a minimum during the winter months. Upon leaving the mountains little or no increment is added to the streams. In the broad, waste-filled valleys they diminish in size, due to evaporation and seepage, and often entirely cease to flow. The following is a brief description of the chief streams of the Great Basin:

Bear River has its source on the northern slope of the Uinta Mountains in the northeastern part of Utah, and after a circuitous course, in which it leaves Utah and enters Wyoming, reenters Utah, appears again in Wyoming, makes a long detour in Idaho, reenters Utah, and finally discharges its waters into Great Salt Lake. Considerable irrigation is practiced on certain portions of the river. Logan River joins it in Cache Valley, Utah.

Weber River rises in the high country east of the Wasatch Mountains. Passing through that range, it appears in the plains region in the vicinity of Ogden, where, after receiving the water of Ogden River, it discharges into Great Salt Lake. There are a number of good reservoir sites on its upper tributaries, some of which recently have been utilized.

City, Parleys, Emigration, Mill, and Big and Little Cottonwood creeks enter Salt Lake Valley from the Wasatch Mountains and are tributary to Jordan River. Their watersheds are small, but the creeks

in the mountain courses maintain perennial flows. On reaching the main valley they are extensively used for irrigation, and the first three furnish the chief water supply for Salt Lake City.

American Fork and Hobble creeks are small streams, tributary to Utah Lake, and Spanish Fork River, next after Provo River, is the most important feeder of Utah Lake.

Provo River rises on the western slope of the Uinta Mountains and after receiving a number of tributaries enters what is known as Heber Valley, where considerable irrigation is practiced. After crossing this valley it passes through the Wasatch Mountains in a picturesque canyon, and finally enters Utah Valley, where its summer flow is completely diverted for irrigation purposes. Its flood waters discharge into Utah Lake.

Sevier River drains a large area in the southwestern part of Utah. It flows northerly until it enters Juab County, then makes a short bend and flows southwest into Sevier Lake. San Pitch River joins Sevier River near Gunnison, Utah.

Humboldt River rises in the extreme northeastern part of Nevada, and flowing across the structural features of the country in a general westerly and southerly direction, finally enters Humboldt Lake, whence its waters find their way into the Humboldt Sink. The tributaries follow the general direction of the mountain ranges, and flow either to the north or to the south. During low stages the water of the river is almost wholly diverted. For the future development of the country recourse must be had to the construction of storage reservoirs. Of its tributaries the North Fork enters it west of Peko, Nev., and the South Fork enters it about 10 miles below Elko, Nev. Pine Creek is a tributary from the south and joins it near Palisade, Nev. Marys River is one of its headwater tributaries.

Walker River is formed by two branches which have their sources in California, but unite in Nevada. It flows north and then takes a sharp bend to the southeast, emptying into Walker Lake.

Carson River has its source on the slopes of the Sierra Nevada in eastern California and flowing northward enters the State of Nevada. The East and West forks unite near Genoa, Nev., in upper Carson Valley. At Empire, 3 miles east of Carson, it turns to the northeast and enters a deep canyon, through which it flows for several miles, emerging into a second smaller valley a short distance above the town of Dayton. After leaving this valley it passes through two other shorter canyons and through one rather large valley before entering lower Carson Valley, or Carson Sink Valley, as it is also known, and discharges its waters into the Carson Sink.

The Truckee has its source on the slopes of the Sierra Nevada, in eastern California, and flows northward, entering Lake Tahoe, which is at an elevation of 6,225 feet and is the largest body of fresh water

in the United States at this considerable altitude. The area of the lake is 193 square miles. Its outlet is at Tahoe, Cal., from which point Truckee River has a general northward and eastward course, receiving several important tributaries which contribute to its flow. It drains into Pyramid and Winnemucca lakes, which have no outlets. Donner and Prosser creeks are tributaries of Truckee River. Independence Creek discharges into the Little Truckee, a main branch of Truckee River, entering it at Boca, Cal. They drain areas of 31, 56, and 8.5 square miles, respectively, lying to the northwest of Lake Tahoe, in California.

Susan River has its source in the Sierra Nevada, in northeastern California, and flowing eastward discharges into Honey Lake—one of the land-locked lakes of the Great Basin—of which it is the principal feeder. A considerable area of land is irrigated from the waters of the river below the gaging station, and during the last ten or twelve years several projects have been started for irrigating other extensive areas by the storage of its waters both above and below the town of Susanville.

BEAR LAKE AT FISHHAVEN, IDAHO.

This station was established October 5, 1903, by W. P. Hardesty. It is located at Fishhaven, Idaho, on the west shore of Bear Lake, about 4 miles north of the Idaho-Utah State line. A plain staff gage, graduated to feet and tenths, is driven vertically into the bed of the lake 10 feet east of a crib where water from a spring rises to the surface. The gage is protected by 2 by 4 inch stakes driven on either side. The spring melts the ice before the regular spring break-up, and the shore at this point is comparatively free from the effects of the ice breaking up, while only a few hundred feet away the ice is piled up in great grinding masses during the breaking-up season. The gage is located on land used as a summer resort, owned by G. C. Gray, of Montpelier, Idaho, and is immediately south of the summer resort known as "Nelson's camp." The gage is read by John L. Nelson when the surface of the lake is calm. An extreme high-water mark pointed out by the observer, who has lived here thirty-three years, indicates that twenty or thirty years ago the surface of the lake was at approximately gage height 6.5 feet. A more definite mark shows a gage height of 6 feet as occurring twenty years ago. Bench mark No. 1 is a wooden hub driven flush with the ground, 1 foot south of a 15-inch cottonwood tree, 1 foot east of fence on east side of the county road, 142 feet north of the gage and about 18° to the west. Its elevation is 12.19 feet above the zero of the gage. Bench mark No. 2 is a shoulder cut on an above-ground root of a 20-inch cottonwood tree 2 feet southeast of the southeast corner of the porch of house on the summer resort grounds. It bears 81° west 93 feet south of the gage

rod. Its elevation is 7.13 feet above the zero of the gage. By readings on the lake surface here and at the north end of the lake, October 5, 1903, the elevation of the zero of the gage was found to be 12.26 by the datum used on canal surveys, etc., during 1903. This elevation is probably correct to within 0.05 foot. The elevation above sea level is approximately 6,000 feet.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Mean daily gage height, in feet, of Bear Lake at Fishhaven, Idaho, for 1903.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1				17			
2		2.50		18			
3				19			
4			2.15	20			
5	2.20	2.50		21		2.10	
6		2.05		22	2.10		
7				23			
8				24			2.10
9				25			
10				26			
11				27			
12	2.05			28			
13				29		2.05	
14		2.07	2.15	30	2.07		
15				31			2.10
16							

Mean daily gage height, in feet, of Bear Lake at Fishhaven, Idaho, for 1904.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.35	2.00		2.60	17	2.45	2.20		2.70	2.50
2		2.35	2.00		2.55	18	2.45	2.20			2.50
3		2.30	2.00		2.55	19	2.42	2.15		2.65	2.50
4		2.30	2.00		2.55	20	2.40	2.15		2.65	2.50
5		2.30	2.00		2.55	21	2.40	2.15		2.65	2.50
6		2.30	2.00		2.55	22	2.40	2.15		2.65	
7		2.30	2.00		2.55	23	2.40	2.10		2.65	
8		2.30	2.00	2.80		24	2.40	2.10		2.65	
9		2.25		2.80		25	2.40	2.10		2.60	2.50
10		2.25				26	2.40	2.10		2.60	2.50
11		2.25		2.75	2.50	27	2.40	2.05		2.60	2.50
12		2.25		2.75	2.50	28	2.40	2.05		2.60	
13		2.25		2.75	2.50	29	2.40	2.00		2.60	
14	2.45	2.20		2.70	2.50	30	2.40	2.00		2.60	
15	2.45	2.20		2.70	2.50	31	2.35				
16	2.45	2.20		2.70							

BEAR RIVER AT DINGLE, IDAHO.

This station was established May 9, 1903, by G. L. Swendsen. It is located in the cut made by the Oregon Short Line Railroad, one-fourth mile east of the railroad station at Dingle. The station is 250 feet south of the railroad track. The original gage was a vertical wooden rod bolted to an iron rod which was driven into the bed of the stream. It was replaced April 15, 1904, by a new vertical gage graduated, to feet and tenths, from 2.5 feet to 10 feet. The zero of the new gage is at the same elevation as that of the old gage, which is 6,015.3 feet above the datum of the Oregon Short Line Railroad levels and 56.54 feet above the datum of the survey for the Bear Lake reservoir project made during the summer of 1903. The gage is read once each day by M. K. Hopkins. Discharge measurements are made by means of a cable and car. The cable has a total span of 151 feet. The initial point for soundings is the zero mark, 8 feet from the end of the cable at the north bank. The channel is straight for 400 feet above and below the station. The velocity is moderate at ordinary stages and is well distributed. Both banks are high, not liable to overflow, and cleared of everything except some small brush. The bed of the stream is composed of gravel, and there is but one channel at all stages. Bench mark No. 1 is a United States Geological Survey standard iron bench-mark post, bearing N. 33° 15′ E. 37 feet from the north end of the cable. Its elevation is 15.59 feet above the zero of the gage. Bench mark No. 2 is the top of the south post of the cable. Its elevation is 18.04 feet above the zero of the gage. Bench mark No. 3 is the top of a 4-foot stick of timber planted 2.7 feet in the ground. Its elevation is 18.42 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Bear River at Dingle, Idaho, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 3 [a]	W. P. Hardesty	522	2.01	6.50	1,051
April 13	do	340	2.64	5.28	898
May 8	C. Tanner	518	3.89	6.73	2,013
June 7	H. S. Kleinschmidt	572	4.63	7.40	2,650
June 28	do	435	3.21	6.04	1,396
August 10	C. Tanner	191	1.41	3.90	271
November 7	W. Swendsen	194	1.39	3.95	270
December 20 [b]	C. Tanner	149	1.65	3.93	246

[a] River frozen at gage.

[b] Stream nearly frozen over.

Mean daily gage height, in feet, of Bear River at Dingle, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[a] 3.60	4.10	6.40	5.40	6.00	7.90	5.60	4.15	4.00	3.90	4.00	4.20
2	3.70	4.10	6.50	4.90	6.00	7.90	5.60	4.10	4.00	3.85	4.00	4.00
3	3.70	4.10	7.00	4.90	6.10	7.95	5.50	4.00	4.00	3.85	4.00	4.00
4	3.80	4.20	6.60	4.70	6.20	8.00	5.50	4.00	4.00	3.80	4.00	4.50
5	3.80	4.20	6.30	4.80	6.30	7.90	5.50	4.00	4.00	3.80	4.00	4.10
6	3.80	4.20	5.80	4.90	6.50	7.60	5.50	4.00	4.00	3.80	4.00	4.60
7	3.80	4.20	5.40	5.10	6.70	7.40	5.50	3.95	4.00	.....	3.95	4.30
8	3.90	4.20	5.50	5.20	6.80	7.30	5.40	3.90	4.00	3.85	3.95	3.90
9	3.80	4.20	4.90	5.10	6.60	7.20	5.40	3.90	4.00	3.90	3.95	4.20
10	3.90	4.20	5.10	5.10	6.60	7.10	5.30	3.90	3.95	3.90	3.95	3.90
11	3.90	4.20	5.20	5.10	6.60	7.00	5.20	3.90	3.90	3.90	3.90	4.10
12	3.90	4.20	5.80	5.20	6.60	6.90	5.15	3.90	3.90	4.00	3.90	4.20
13	3.90	4.20	5.50	5.40	6.60	6.85	5.10	4.10	3.90	4.00	4.00	4.10
14	4.00	4.20	5.30	5.50	6.60	6.70	5.10	4.10	3.90	4.00	4.10	3.90
15	4.00	4.20	5.00	5.80	6.70	6.60	5.00	3.90	3.90	.....	3.60	3.90
16	4.00	4.20	5.20	6.00	6.90	6.60	5.00	3.90	3.90	4.00	4.30	3.90
17	4.00	4.20	4.90	6.10	6.95	6.80	4.90	4.00	3.90	4.00	4.50	4.30
18	4.00	4.20	4.80	6.00	7.00	6.80	4.80	4.00	3.90	4.00	4.00	4.10
19	4.00	4.20	4.90	5.90	7.20	6.80	4.75	4.00	3.90	4.00	4.00	3.90
20	4.00	4.20	4.90	5.90	7.30	6.70	4.70	4.00	3.90	4.00	3.80	4.10
21	4.00	4.20	5.00	5.90	7.40	6.60	4.70	4.00	3.90	4.00	3.80	4.00
22	4.00	4.20	5.20	5.95	7.50	6.60	4.50	4.10	3.90	4.00	4.30	3.90
23	4.00	4.40	5.40	5.90	7.70	6.55	4.40	4.10	3.90	4.00	4.40	4.10
24	4.00	4.40	5.60	5.80	7.75	6.50	4.40	4.20	3.90	4.00	4.80	3.90
25	4.00	4.40	.....	5.70	7.80	6.40	4.35	4.40	3.90	4.00	4.30	4.00
26	4.00	4.60	5.20	5.70	7.90	6.20	4.30	4.20	3.90	4.00	4.60	4.00
27	4.00	4.80	5.10	5.80	8.00	6.20	4.25	4.10	3.90	4.00	4.00	[b] 4.30
28	4.00	5.70	4.80	5.90	8.00	6.05	4.30	4.00	3.90	4.00	4.20	5.40
29	4.00	6.75	4.70	5.90	7.90	5.90	4.20	4.00	3.90	4.00	4.40	5.20
30	4.10	.....	4.70	6.00	7.90	5.75	4.20	.....	3.90	4.00	4.40	5.30
31	4.10	.....	5.00	.....	7.90	.....	4.20	4.00	.....	4.00	.....	4.70

[a] River frozen from Jan. 1 to Mar. 7. Gage read to surface of ice. Above gage heights have been corrected for ice conditions before applying the rating table.

[b] Gage heights December 27-31 are too high owing to ice conditions. Have been corrected to 4.0 feet in getting discharge.

Rating table for Bear River at Dingle, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.10	60	4.20	370	5.30	895	6.40	1,730
3.20	75	4.30	410	5.40	955	6.60	1,910
3.30	90	4.40	455	5.50	1,020	6.80	2,090
3.40	110	4.50	495	5.60	1,085	7.00	2,275
3.50	135	4.60	540	5.70	1,155	7.20	2,455
3.60	160	4.70	590	5.80	1,230	7.40	2,635
3.70	190	4.80	635	5.90	1,300	7.60	2,815
3.80	225	4.90	685	6.00	1,375	7.80	2,995
3.90	260	5.00	740	6.10	1,460	8.00	3,175
4.00	295	5.10	790	6.20	1,550		
4.10	330	5.20	840	6.30	1,640		

The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements made during 1903 and 1904. It is well defined between gage heights 3.50 feet and 7.40 feet. The table has been extended beyond these limits. Above gage height 6.10 feet the rating curve is a tangent, the difference being 90 per tenth.

Estimated monthly discharge of Bear River at Dingle, Idaho, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	110	60	87.3	5,368
February	590	110	215	12,370
March	1,230	590	854	52,510
April	1,460	590	1,059	63,020
May	3,175	1,375	2,302	141,500
June	3,175	1,190	2,177	129,500
July	1,085	370	711	43,730
August	455	260	305	18,750
September	295	260	271	16,130
October	295	225	277	17,030
November	635	160	339	20,170
December	540	260	322	19,800
The year	3,175	60	743	539,900

BEAR RIVER NEAR PRESTON, IDAHO.

This station, established October 11, 1889, is about 6 miles from Preston, Idaho, and 10 miles north of the Utah-Idaho boundary line. The station is of considerable importance from the fact that its location is near the Utah-Idaho line, and the measurements there will indicate the volume of water that passes from Idaho into Utah. During 1901 a large canal was completed, appropriating the waters of Bear River about 8 miles below Soda Springs in sufficient quantity to irrigate about 35,000 acres of very fine land in that locality. The original gage consisted of a vertical board nailed to a pile of the highway bridge. This was carried away June 30, 1899, but was replaced on August 4 by a wire gage. It is read by J. A. Nelson. Discharge measurements are made by means of a cable and car. The initial point for soundings is the post over which the cable passes on the right bank. The channel is straight for 250 feet above and below the station. Both banks are high, clean, and not liable to overflow. The bed of the stream is smooth, and there is but one channel at low water. The bench mark for the readings of 1903 is that of the old gage, which is a nail in the southeast corner of a house near the gage, about 1.5 feet from the ground and 10.95 feet above gage datum. Because of some difficulty in maintaining the wire gage, a temporary gage was nailed to the pile of the highway bridge above the station. The readings of this gage have been reduced to the same datum as the wire gage. On October 31, 1903, a new gage was nailed to a pile on the highway bridge above the station. Its elevation is 10.80 feet below the old bench mark, therefore the gage heights from November 1 to December 31, 1903, have been increased 0.15 foot.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Bear River near Preston, Idaho, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 7	W. Swendsen	1,182	4.03	4.65	4,757
June 9	do	1,013	4.42	4.70	4,448
July 6	W. D. Beers	571	2.60	2.58	1,482
November 5	W. Swendsen	374	1.92	1.55	718
December 18	C. Tanner	391	1.88	1.60	733

Mean daily gage height, in feet, of Bear River near Preston, Idaho, for 1904.

Day.	Jan.[a]	Feb.[a]	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov,	Dec.
1	1.25	1.35	1.90	2.70	3.75	4.95	2.90	1.15	1.40	1.35	1.57	1.45
2	1.25	1.35	1.85	2.70	3.75	4.95	2.70	1.15	1.40	1.35	1.55	1.45
3	1.25	1.35	2.05	2.75	3.87	5.00	2.52	1.15	1.37	1.37	1.55	1.42
4	1.25	1.35	2.20	2.80	4.20	4.95	2.47	1.10	1.35	1.40	1.55	1.45
5	1.25	1.35	2.55	2.85	4.20	4.95	2.45	1.10	1.35	1.40	1.55	1.45
6	1.25	1.35	2.55	2.95	4.25	4.90	2.45	1.05	1.35	1.40	1.55	1.45
7	1.25	1.35	2.55	2.95	4.25	4.90	2.40	1.05	1.35	1.40	1.55	1.45
8	1.25	1.35	2.85	2.95	4.27	4.72	2.35	1.00	1.30	1.40	1.55	1.45
9	1.25	1.35	2.85	2.97	4.30	4.65	2.35	1.00	1.30	1.40	1.55	1.45
10	1.25	1.35	2.87	3.20	4.30	4.57	2.32	.95	1.30	1.40	1.55	1.45
11	1.25	1.35	2.85	3.35	4.30	4.52	2.32	.95	1.30	1.40	1.55	1.45
12	1.25	1.35	2.35	3.50	4.30	4.47	2.27	.95	1.25	1.45	1.55	1.45
13	1.25	1.35	2.35	3.70	4.30	4.40	2.25	.95	1.25	1.45	1.55	1.45
14	1.25	1.35	2.35	3.90	4.35	4.20	2.25	.95	1.25	1.45	1.55	1.45
15	1.25	1.45	2.55	4.12	4.35	4.10	2.15	.95	1.25	1.45	1.55	1.45
16	1.25	1.45	2.55	4.16	4.35	3.95	2.15	.95	1.25	1.55	1.55	1.45
17	1.25	1.50	2.55	4.16	4.35	3.87	2.07	1.00	1.25	1.60	1.55	1.45
18	1.35	1.55	2.70	4.15	4.35	3.80	2.00	1.15	1.25	1.60	1.50	1.55
19	1.35	1.55	3.05	4.10	4.40	3.72	1.92	1.15	1.25	1.60	1.50	1.55
20	1.35	1.55	3.20	4.16	4.45	3.65	1.85	1.15	1.25	1.60	1.50	1.55
21	1.35	1.55	2.90	4.20	4.45	3.57	1.77	1.15	1.25	1.60	1.45	1.55
22	1.35	1.65	2.87	4.15	4.57	3.55	1.67	1.15	1.25	1.60	1.45	1.60
23	1.35	2.40	2.85	4.15	4.62	3.55	1.62	1.15	1.25	1.60	1.45	1.45
24	1.35	1.95	2.85	4.07	4.67	3.55	1.55	1.25	1.25	1.60	1.45	1.45
25	1.35	2.10	2.85	3.95	4.72	3.47	1.47	1.30	1.25	1.60	1.45	1.45
26	1.35	2.35	2.85	3.87	4.75	3.45	1.45	1.35	1.25	1.60	1.45	1.45
27	1.35	2.25	2.85	3.85	4.77	3.40	1.40	1.35	1.32	1.60	1.45	1.45
28	1.35	2.05	2.85	3.85	4.82	3.35	1.40	1.37	1.35	1.60	1.45	1.45
29	1.35	2.05	2.85	3.80	4.85	3.27	1.40	1.45	1.35	1.60	1.45	1.45
30	1.35	.....	2.85	3.75	4.92	3.10	1.40	1.45	1.35	1.60	1.45	1.45
31	1.35	.....	2.85	.....	4.95	.....	1.40	1.42	.....	1.60	.....	1.45

[a] Gage heights estimated January 1 to February 5, as river was frozen.

Rating table for Bear River near Preston, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.95	483	1.90	905	2.90	1,845	3.90	3,245
1.00	500	2.00	970	3.00	1,970	4.00	3,400
1.10	535	2.10	1,040	3.10	2,100	4.10	3,555
1.20	570	2.20	1,115	3.20	2,235	4.20	3,715
1.30	610	2.30	1,200	3.30	2,370	4.30	3,875
1.40	650	2.40	1,295	3.40	2,510	4.40	4,035
1.50	695	2.50	1,395	3.50	2,650	4.60	4,365
1.60	740	2.60	1,500	3.60	2,795	4.80	4,705
1.70	790	2.70	1,610	3.70	2,945	5.00	5,050
1.80	845	2.80	1,725	3.80	3,095		

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is not well defined, owing to lack of sufficient measurements.

Estimated monthly discharge of Bear River near Preston, Idaho, for 1904.

[Drainage area, 4,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	630	590	608	37,380	0.135	0.156
February	1,295	630	765	44,000	.170	.183
March	2,235	875	1,584	97,400	.352	.406
April	3,715	1,610	2,824	168,000	.628	.701
May	4,963	3,020	4,063	249,800	.903	1.04
June	5,050	2,100	3,621	215,500	.805	.898
July	1,845	650	1,041	64,010	.231	.266
August	672	483	550	33,820	.122	.141
September	650	590	609	36,240	.135	.151
October	740	630	697	42,860	.155	.179
November	727	672	700	41,650	.156	.174
December	740	659	680	41,810	.151	.174
The year	5,050	483	1,478	1,072,000	.329	4.47

BEAR RIVER NEAR COLLINSTON, UTAH.

This station was established July 1, 1889, by Samuel Fortier. It is located about 4 miles from the railroad station at Collinston, 2 miles east of Fielding, Utah, and below the headworks of the Bear River canal. The gage is a vertical iron rod graduated to tenths of a foot. There is also an iron gage fastened in a hole drilled in bed rock for low-water readings. The gage is read by D. A. Cannon. Discharge measurements are now made one-fourth mile above the gage from the bridge carrying the water-supply pipe of the Utah Light and Power Company. The section is only fair for high-water measurements, but good for low water. The right bank is high and sloping. The left bank is a steep cliff about 100 feet high, composed of gravel. The bed of the stream is solid rock covered with small stones. The bench mark is a nail in an oak post 20 feet west of the gage and 20 feet north of the cable at which discharge measurements were formerly taken. Its elevation is 7.35 feet above gage datum.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Bear River near Collinston, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per sec.*	*Feet.*	*Second-feet.*
January 29	C. Tanner	216	2.92	1.37	802
March 5	W. P. Hardesty	434	5.06	2.70	2,300
May 10	C. Tanner	801	7.72	5.43	6,334
June 8	W. Swendsen	700	7.51	5.33	5,262
July 7	W. D. Beers	418	4.30	2.57	1,961
August 14	C. Tanner	139	1.80	.80	250
December 16	do	346	2.57	1.96	984

Mean daily gage height, in feet, of Bear River near Collinston, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.40	1.40	2.70	3.70	4.90	5.50	3.10	0.90	1.50	1.60	1.80	1.90
2	1.40	1.40	2.70	3.60	5.00	5.50	3.00	.90	1.40	1.60	1.80	1.90
3	1.50	1.40	2.70	3.50	5.00	5.50	2.90	.90	1.30	1.50	1.80	1.90
4	1.50	1.50	2.70	3.50	5.00	5.60	2.70	.90	1.30	1.50	1.90	1.95
5	1.50	1.50	2.70	3.40	5.30	5.60	2.60	.90	1.20	1.50	1.90	1.60
6	1.50	1.50	2.80	3.40	5.40	5.50	2.60	.90	1.20	1.50	1.90	1.60
7	1.50	1.50	2.90	3.50	5.30	5.50	2.50	.80	1.10	1.50	1.90	1.60
8	1.50	1.50	3.20	3.50	5.50	5.40	2.50	.80	1.10	1.50	1.90	1.80
9	1.50	1.50	3.90	3.40	5.30	5.30	2.50	.80	1.00	1.60	1.80	1.90
10	1.40	1.50	4.10	3.50	5.30	5.20	2.40	.80	1.10	1.60	1.80	1.90
11	1.30	1.40	3.90	3.60	5.30	5.10	2.30	.80	1.10	1.70	1.80	1.90
12	1.40	1.40	3.40	3.90	5.40	5.10	2.20	.80	1.00	1.70	1.90	1.90
13	1.40	1.50	3.20	4.20	5.50	5.00	2.10	.80	1.00	1.70	1.90	1.90
14	1.40	1.60	3.00	4.30	5.40	4.90	2.00	.80	1.10	1.80	1.90	1.90
15	1.40	1.60	3.00	4.50	5.50	4.80	1.90	.80	1.20	1.70	1.80	1.80
16	1.40	1.60	3.00	4.80	5.60	4.70	1.80	.80	1.20	1.80	1.80	1.90
17	1.50	1.80	3.10	5.00	5.60	4.50	1.70	.80	1.30	1.80	1.90	1.90
18	1.40	1.90	3.10	5.10	5.60	4.40	1.70	.90	1.20	1.80	1.90	1.80
19	1.40	1.80	3.50	5.00	5.50	4.30	1.70	1.10	1.30	1.90	1.90	1.90
20	1.40	1.70	3.90	5.10	5.50	4.20	1.60	1.20	1.30	1.90	1.90	1.90
21	1.40	1.50	4.10	5.20	5.50	4.10	1.50	1.10	1.30	1.90	1.90	2.00
22	1.40	1.80	4.00	5.40	5.50	4.00	1.40	1.00	1.30	1.90	1.80	2.00
23	1.40	2.90	3.70	5.30	5.60	3.90	1.30	1.00	1.30	1.90	1.80	2.00
24	1.40	4.00	3.70	5.20	5.60	3.80	1.20	1.10	1.40	1.90	1.80	2.00
25	1.40	4.20	3.70	5.20	5.70	3.80	1.10	1.20	1.40	1.90	1.80	2.00
26	1.30	4.20	3.50	5.10	5.70	3.60	1.20	1.30	1.50	1.90	1.80	2.00
27	1.30	4.10	3.30	5.00	5.70	3.50	1.10	1.40	1.50	1.90	1.70	2.00
28	1.30	3.40	3.40	4.90	5.70	3.40	1.00	1.40	1.50	1.80	1.80	1.90
29	1.40	2.90	3.60	5.00	5.60	3.20	.90	1.50	1.60	1.90	1.90	1.90
30	1.40	.....	3.80	5.00	5.50	3.20	.90	1.60	1.60	1.80	1.90	1.90
31	1.40	.....	3.80	.....	5.50	.....	.90	1.50	.....	1.80	.....	1.90

Rating table for Bear River near Collinston, Utah, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage heights.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.80	270	2.10	1,330	3.40	3,250	4.70	5,200
.90	300	2.20	1,470	3.50	3,400	4.80	5,350
1.00	340	2.30	1,610	3.60	3,550	4.90	5,500
1.10	390	2.40	1,750	3.70	3,700	5.00	5,650
1.20	450	2.50	1,900	3.80	3,850	5.10	5,800
1.30	520	2.60	2,050	3.90	4,000	5.20	5,950
1.40	600	2.70	2,200	4.00	4,150	5.30	6,100
1.50	680	2.80	2,350	4.10	4,300	5.40	6,250
1.60	760	2.90	2,500	4.20	4,450	5.50	6,400
1.70	860	3.00	2,650	4.30	4,600	5.60	6,550
1.80	970	3.10	2,800	4.40	4,750	5.70	6,700
1.90	1,080	3.20	2,950	4.50	4,900		
2.00	1,200	3.30	3,100	4.60	5,050		

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is not well defined owing to poor conditions at station

Estimated monthly discharge of Bear River near Collinston, Utah, for 1904.

[Drainage area, 6,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	680	520	610	37,510	0.102	0.118
February	4,450	600	1,443	83,000	.240	.259
March	4,300	2,200	3,187	196,000	.531	.612
April	6,250	3,250	4,740	282,000	.790	.881
May	6,700	5,500	6,303	387,600	1.05	1.21
June	6,550	2,950	5,055	300,800	.842	.939
July	2,800	300	1,207	74,220	.201	.232
August	760	270	376	23,120	.063	.073
September	760	340	514	30,580	.086	.096
October	1,080	680	908	55,830	.151	.174
November	1,080	860	1,021	60,750	.170	.190
December	1,200	760	1,067	65,610	.178	.205
The year	6,700	270	2,203	1,597,000	.367	4.99

LOGAN RIVER NEAR LOGAN, UTAH.

The station on Logan River was established June 1, 1896, about 2 miles east of Logan, Utah. The original equipment consisted of a cable and car and two gages. One gage was a vertical iron post set in the bed of the stream, and the other a vertical wooden gage near the above. The bench mark for both gages is a stone marked "B. M., 35 ft." northwest of the wooden gage. Its elevation is 14.01 feet above gage datum. The station was discontinued July 18, 1903. It was reestablished April 13, 1904, along the canyon road, 50 feet below the bridge over the river at the mouth of the canyon, and 800 feet below Hercules power house. The gage is a steel rod, graduated to feet and tenths, driven into the bed of the stream. The upstream edge is rounded or drawn to an edge. Observations are taken by the Hercules Power Company. Discharge measurements are made by means of a cable and car. The initial point for soundings is a 4 by 4 inch post set in the west bank of the river about 3 feet below the cable line. The channel is straight for 150 feet above and 75 feet below the station. The current is swift. Both banks are high, rocky, and covered with small brush. The bed of the stream is composed of cement gravel and bowlders. When the station was reestablished in 1904 the channel was improved by removing large bowlders and other material, to distribute the flow throughout the cross section. During the spring flood new material was deposited, and still remains in a loose state. There is but one channel at all stages. The bench mark is a United States Geological Survey standard metallic plug cemented in a solid limestone ledge. Its elevation is 24.85 feet above the zero of the gage, and 4,502 feet above sea level.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Logan River near Logan, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
April 23	W. Swendsen	91	4.62	5.10	422
April 25	do	93	4.42	5.00	411
May 4	do	111	5.02	5.50	555
May 5	do	128	5.22	5.70	665
May 9	do	127	5.32	5.70	673
May 11	do	127	5.31	5.70	674
May 17	do	152	6.07	6.20	923
June 4	do	157	6.43	6.25	1,010
July 3	W. D. Beers	129	5.71	5.50	736
August 15	C. Tanner	72	3.41	4.70	244
November 3	W. Swendsen	57	3.05	4.60	173
December 17	C. Tanner	50	2.95	4.40	147

Mean daily gage height, in feet, of Logan River near Logan, Utah, for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.56	6.50	5.60	4.90	4.60	4.50	4.55	4.45
2	.....	5.40	6.45	5.60	4.85	4.60	4.60	4.55	4.45
3	.....	5.50	6.35	5.55	4.85	4.60	4.60	4.55	4.45
4	.....	5.55	6.10	5.55	4.80	4.60	4.60	4.55	4.45
5	.....	5.55	6.35	5.50	4.80	4.60	4.60	4.55	4.45
6	.....	5.50	6.20	5.50	4.80	4.65	4.60	4.55	4.45
7	.....	5.70	6.15	5.45	4.80	4.65	4.60	4.55	4.45
8	.....	5.70	6.10	5.40	4.80	4.65	4.60	4.55	4.45
9	.....	5.70	6.05	5.40	4.80	4.65	4.60	4.55	4.45
10	.....	5.80	6.10	5.35	4.80	4.65	4.70	4.50	4.48
11	.....	5.90	6.15	5.30	4.80	4.60	4.60	4.50	4.45
12	.....	5.90	6.10	5.40	4.80	4.60	4.60	4.50	4.48
13	.....	6.00	6.10	5.30	4.80	4.60	4.60	4.50	4.48
14	.....	6.00	6.15	5.30	4.80	4.50	4.60	4.50	4.48
15	.....	6.20	6.15	5.20	4.75	4.60	4.60	4.50	4.48
16	.....	6.20	6.20	5.20	4.75	4.60	4.60	4.50	4.48
17	.....	6.20	6.15	5.20	4.80	4.60	4.60	4.55	4.48
18	.....	6.30	6.20	5.15	4.75	4.60	4.60	4.55	4.48
19	.....	6.30	6.25	5.10	4.75	4.60	4.60	4.55	4.48
20	.....	6.40	6.20	5.05	4.70	4.60	4.60	4.50	4.48
21	.....	6.40	6.10	5.05	4.70	4.70	4.60	4.50	4.48
22	.....	6.40	6.00	5.00	4.70	4.80	4.60	4.45	4.48
23	.....	6.60	6.00	5.00	4.70	4.80	4.60	4.45	4.48
24	.....	6.95	5.90	5.00	4.70	4.85	4.55	4.45	4.48
25	5.00	6.60	5.80	5.00	4.60	4.80	4.55	4.45	4.48
26	5.10	6.40	5.80	5.00	4.60	4.80	4.55	4.45	4.48
27	5.10	6.30	5.70	5.00	4.60	4.75	4.55	4.45	4.48
28	5.20	6.20	5.70	4.90	4.70	4.60	4.55	4.45	4.48
29	5.10	6.30	5.75	4.90	4.70	4.50	4.55	4.45	4.48
30	5.50	6.40	5.60	4.90	4.70	4.50	4.55	4.45	4.48
31	.....	6.45	.....	4.90	4.60	.....	4.55	.....	4.48

Rating table for Logan River near Logan, Utah, from April 25 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.45	150	4.85	288	5.50	577	6.30	996
4.50	164	4.90	308	5.60	625	6.40	1,052
4.55	179	4.95	329	5.70	675	6.50	1,108
4.60	195	5.00	350	5.80	726	6.60	1,164
4.65	212	5.10	394	5.90	779	6.70	1,222
4.70	230	5.20	438	6.00	833	6.80	1,280
4.75	249	5.30	483	6.10	887	6.90	1,338
4.80	268	5.40	529	6.20	941		

The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1904. It is fairly well defined between gage heights 4.40 feet and 6.25 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Logan River near Logan, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 25–30	577	350	424	5,046
May	1,367	529	878	53,990
June	1,108	625	876	52,130
July	625	308	448	27,550
August	308	195	249	15,310
September	288	164	211	12,560
October	230	164	191	11,740
November	179	150	167	9,937
December	158	150	155	9,531
The period				197,800

Mean daily gage height, in feet, of Logan River, Hyde Park, and Smithfield canal, near Logan, Utah, for 1904.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		5.90	5.80	5.40	17	5.50	5.90	5.70	
2		5.82	5.80	5.40	18	5.50	5.90	5.70	
3		5.90	5.90	5.40	19	5.60	5.80	5.70	
4		5.80	5.90	5.40	20	5.70	5.80	5.70	
5	5.35	5.80	5.80	5.50	21	5.70	5.90	5.70	
6	5.35	5.90	5.90	5.40	22	5.80	5.80	5.70	
7	5.35	5.80	5.80	5.40	23	5.80	5.90	5.60	
8	5.40	5.80	5.80	5.50	24	5.70	5.90	5.60	
9		5.70	5.80	5.40	25	5.80	5.90	5.60	
10	5.25	5.80	5.80	5.40	26	5.90	5.90	5.60	
11	5.35	5.80	5.70		27	5.70	5.80	5.60	
12	5.40	5.70	5.70		28	5.70	5.90	5.50	
13	5.50	5.90	8.70		29	5.80	5.80	5.50	
14	5.50	5.90	5.70		30	5.80	5.80	5.50	
15	5.60	5.90	5.70		31		5.90	5.40	
16	5.60	5.90	5.70						

BLACKSMITH FORK NEAR HYRUM, UTAH.

A gaging station was maintained near the tollgate near Hyrum, Utah, from July 19, 1900, to December 31, 1902.

A new station was established May 16, 1904, by W. G. Swendsen. It is located about 1,000 feet downstream from the tollgate at the mouth of the canyon, about 800 feet upstream from the city electric light plant at Hyrum, Utah. A plain staff gage, graduated to feet and tenths, is driven vertically into the bed of the stream and braced to the south bank. The gage is read daily by Uriah Benson. Discharge measurements are made by means of a cable and car. The initial point for soundings is the support at the south end of the cable. The channel is straight for 200 feet above and 50 feet below the station. The current is swift. The right bank for 20 feet back is a low wooded flat, which is subject to overflow during high water. The right bank is high and does not overflow. The bed of the stream is composed of cement, bowlders, and gravel, and is permanent. There is but one channel at all stages. The depth of the water during high stages is about 3 feet. Bench mark No. 1 is a United States Geological Survey metallic plug set in the limestone ledge with cement. Its elevation is 17.875 feet above the zero of the gage. Bench mark No. 2 is the top of the eyebolt of north cable anchor. Its elevation is 9.578 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Blacksmith Fork near Hyrum, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 16	W. Swendsen	116	5.05	5.20	578
June 4	do	73	4.19	4.40	305
July 4	W. D. Beers	57	3.34	3.90	191
August 15	C. Tanner	47	2.89	3.78	136
November 2	W. Swendsen	47	2.59	3.65	122
December 17	C. Tanner	38	2.31	3.56	88

Mean daily gage height, in feet, of Blacksmith Fork near Hyrum, Utah, for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.35	4.00	3.80	3.80	3.70	3.65	3.60
2	.....	4.35	3.90	3.80	3.70	3.70	3.65	3.60
3	.....	4.35	3.90	3.80	3.70	3.70	3.65	3.60
4	.....	4.40	3.90	3.80	3.70	3.70	3.65	3.60
5	.....	4.40	3.90	3.80	3.70	3.70	3.65	3.60
6	.....	4.40	3.90	3.80	3.70	3.70	3.60	3.60
7	.....	4.40	3.90	3.80	3.70	3.70	3.60	3.50
8	.....	4.40	3.90	3.80	3.70	3.70	3.60	3.50
9	.....	4.40	3.90	3.80	3.70	3.70	3.60	3.50
10	.....	4.30	3.90	3.80	3.70	3.70	3.60	3.50
11	.....	4.20	3.90	3.80	3.70	3.70	3.60	3.50
12	.....	4.20	3.90	3.80	3.70	3.80	3.60	3.50
13	.....	4.20	3.90	3.80	3.70	3.80	3.60	3.50
14	.....	4.20	3.90	3.80	3.70	3.80	3.60	3.50
15	.....	4.10	3.90	3.80	3.70	3.80	3.60	3.50
16	5.50	4.10	3.90	3.80	3.70	3.80	3.60	3.50
17	5.50	4.00	3.80	3.80	3.70	3.80	3.60	3.40
18	5.50	4.00	3.80	3.80	3.70	3.70	3.60	3.60
19	5.50	4.10	3.80	3.80	3.70	3.70	3.60	3.60
20	5.50	4.10	3.80	3.80	3.70	3.70	3.60	3.60
21	5.50	4.10	3.80	3.80	3.70	3.70	3.60	3.60
22	5.90	4.10	3.80	3.80	3.70	3.70	3.60	3.60
23	5.00	4.10	3.80	4.00	3.70	3.70	3.60	3.60
24	5.00	4.10	3.80	4.00	3.70	3.70	3.60	3.60
25	4.30	4.00	3.80	4.00	3.70	3.70	3.60	3.50
26	4.30	4.00	3.80	3.90	3.70	3.70	3.60	3.50
27	4.30	4.00	3.80	3.90	3.70	3.70	3.60	3.40
28	4.30	4.00	3.80	3.80	3.70	3.70	3.60	3.40
29	4.30	4.00	3.80	3.80	3.70	2.70	3.60	3.40
30	4.30	4.00	3.80	3.80	3.70	3.70	3.60	3.50
31	4.30	.....	3.80	3.80	.....	3.70	.....	3.50

Rating table for Blacksmith Fork near Hyrum, Utah, from May 16 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.40	80	4.10	215	4.80	438	5.50	695
3.50	88	4.20	244	4.90	474	5.60	734
3.60	105	4.30	273	5.00	510	5.70	772
3.70	122	4.40	305	5.10	546	5.80	810
3.80	140	4.50	337	5.20	581	5.90	848
3.90	160	4.60	370	5.30	618	6.00	887
4.00	186	4.70	403	5.40	656		

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 3.50 feet and 5.20 feet. The table has been extended beyond these limits. Above gage height 5.30 feet the rating curve is a tangent, the difference being 38 + per tenth.

Estimated monthly discharge of Blacksmith Fork near Hyrum, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 16–31	848	273	497	15,770
June	305	186	238	14,160
July	186	140	151	9,285
August	186	140	146	8,977
September	140	122	123	7,319
October	140	122	125	7,686
November	113	105	106	6,307
December	105	80	94.1	5,786
The period				75,290

BLACKSMITH FORK POWER PLANT RACE NEAR HYRUM, UTAH.

[Blacksmith Fork Aqueduct.]

This station was established May 16, 1904, by W. G. Swendsen. It is located about 600 feet down the canyon road from the tollgate at mouth of canyon, about 200 feet below the head of the canal or race, and about 500 feet south of the river station. The gage is an iron rod, graduated to feet and tenths, driven vertically into the bed of the stream and braced to a foot plank. It is read daily by Uriah Benson. Discharge measurements are made from the foot plank to which the gage is fastened. The initial point for soundings is a zero mark on the plank. The channel is straight for 100 feet above and 200 feet below the station. The current has a velocity of about 3½ feet per second. Both banks are high and composed of fine gravel. The bed of the stream is composed of fine gravel, and is apparently permanent. There is but one channel at all stages. Bench mark No. 1 is a point marked with red paint on a projecting rock of the foundation of rock house 400 feet northwest of the gage. Its elevation is 8.845 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Blacksmith Fork power plant race near Hyrum, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 16	W. Swendsen	31	2.71	4.80	84
June 4	do	30	2.16	4.60	63
July 4	W. D. Beers	25	2.20	4.45	55
August 15	C. Tanner	24	2.52	4.47	59
November 2	W. Swendsen	21	2.44	4.35	50
December 17	C. Tanner	20	1.96	4.30	40

Mean daily gage height, in feet, of Blacksmith Fork power plant race near Hyrum, Utah, for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.70	4.40	4.50	4.50	4.30	4.30	4.30
2	.....	4.70	4.40	4.50	4.40	4.30	4.30	4.30
3	.....	4.70	4.50	4.50	4.40	4.30	4.30	4.30
4	.....	4.60	4.50	4.50	4.40	4.30	4.30	4.30
5	.....	4.60	4.50	4.40	4.40	4.30	4.30	4.30
6	.....	4.60	4.50	4.40	4.40	4.30	4.30	4.30
7	.....	4.60	4.50	4.50	4.40	4.30	4.30	4.40
8	.....	4.60	4.50	4.50	4.40	4.30	4.30	4.40
9	.....	4.60	4.50	4.50	4.40	4.30	4.30	4.40
10	.....	4.40	4.50	4.50	4.40	4.30	4.30	4.40
11	.....	4.60	4.50	4.50	4.40	4.30	4.30	4.40
12	.....	4.50	4.50	4.50	4.40	4.40	4.30	4.40
13	.....	4.50	4.50	4.50	4.40	4.40	4.30	4.40
14	.....	4.50	4.50	4.50	4.40	4.40	4.30	4.40
15	.....	4.60	4.50	4.50	4.40	4.40	4.30	4.40
16	4.80	4.60	4.50	4.50	4.40	4.40	4.30	4.40
17	4.80	4.50	4.50	4.50	4.40	4.40	4.30	4.30
18	4.80	4.50	4.50	4.50	4.40	4.30	4.30	4.30
19	4.80	4.50	4.50	4.50	4.40	4.30	4.30	4.30
20	4.80	4.50	4.50	4.50	4.40	4.30	4.30	4.30
21	4.80	4.50	4.50	4.50	4.40	4.30	4.30	4.30
22	4.70	4.50	4.50	4.50	4.40	4.30	4.30	4.40
23	4.70	4.50	4.50	4.50	4.40	4.30	4.30	4.40
24	4.90	4.50	4.50	4.50	4.40	4.30	4.30	4.40
25	4.90	4.40	4.50	4.50	4.40	4.30	4.30	4.40
26	4.70	4.40	4.50	4.50	4.40	4.30	4.30	4.30
27	4.70	4.40	4.50	4.50	4.40	4.30	4.30	4.20
28	4.60	4.40	4.50	4.50	4.40	4.30	4.30	4.30
29	4.70	4.40	4.50	4.50	4.40	4.30	4.30	4.40
30	4.70	4.40	4.50	4.50	4.40	4.30	4.30	4.40
31	4.70	.....	4.50	4.50	.....	4.30	.....	4.50

Rating table for Blacksmith Fork power plant race near Hyrum, Utah, from May 16 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.30	42	4.50	59	4.70	76	4.90	93
4.40	50	4.60	68	4.80	85		

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is fairly well defined between gage heights 4.30 and 4.80 feet.

Estimated monthly discharge of Blacksmith Fork power plant race near Hyrum, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 16–31	93	68	81.0	2,571
June	76	50	61.3	3,648
July	59	50	58.4	3,591
August	59	50	58.4	3,591
September	59	50	50.3	2,993
October	50	42	43.5	2,675
November	42	42	42.0	2,499
December	59	33	46.4	2,853
The period				24,420

WEBER RIVER NEAR OAKLEY, UTAH.

This station was established October 22, 1904, by W. D. Beers. It is located 3 miles above Oakley, Utah, above all diversions to the Kamas prairie region. The station is about 200 feet south of the wagon road. The gage is composed of three sections of iron bar bolted in an inclined position to the limestone ledge at the left bank of the river. It is graduated to read direct to feet and tenths. The gage is read once each day by John Franson. Discharge measurements are made by means of a cable and car. The initial point for soundings is the anchor bolt at the left end of the cable. The channel is straight for 300 feet above, and 250 feet below the station. The current is very swift. The right bank is a low wooded bottom for 200 feet back and is liable to overflow slightly during very high water. The right bank is a high brush-covered ledge and is not subject to overflow. The bed of the stream is composed of coarse gravel

and cobblestones, which are liable to shift in high floods. There is but one channel at all stages, excepting a small depression which carries a small amount of water during very high floods. Flood velocities are very high, and it is necessary to use a suitable meter and a guy line. The bench mark is a United States Geological Survey bolt set in the limestone ledge about 0.5 foot from the initial point for soundings. Its elevation is 14.79 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Weber River near Oakley, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per sec.*	*Feet.*	*Second-feet.*
October 22	W. D. Beers	57	1.50	4.27	86
December 13 [a]	do	105	1.00	5.55	107

[a] Measurement made through ice.

Mean daily gage height, in feet, of Weber River near Oakley, Utah, for 1904.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		4.20	[a] 4.15	12		4.20	([a])	22		4.15	([a])
2		4.20	[a] 4.15	13		4.20	[a] 5.55	23	4.25	4.15	([a])
3		4.20	[a] 4.35	14		4.35	([a])	24	4.25	4.15	([a])
4		([a])	[a] 5.45	15		4.35	[a] 5.20	25	4.25	4.15	([a])
5		4.20	[a] 5.45	16		4.15	([a])	26	4.25	4.15	([a])
6		4.20	[a] 5.40	17		4.15	([a])	27	4.25	[a] 4.20	([a])
7		4.20	[a] 5.55	18		4.15	([a])	28	4.25	[a] 4.20	[a] 5.60
8		4.20	[a] 5.55	19		4.15	([a])	29	4.25	([a])	([a])
9		4.20	[a] 5.65	20		4.15	[b] 4.62	30	4.25	[a] 4.25	([a])
10		4.20	[a] 5.70	21		4.15	([a])	31	4.25		([a])
11		4.20	[a] 5.55								

[a] Ice. [b] Ice 11 inches thick.

CHALK CREEK AT COALVILLE, UTAH.

This station was established October 23, 1904, by W. D. Beers. It is located at the foot bridge on the main road leading north, one-eighth mile from the court-house at Coalville, Utah. A vertical staff gage, graduated to feet and tenths, is attached to a pile near the right bank of the stream. It is read once each day by Miss Eva Rees. Discharge measurements are made from the foot bridge at which the gage is located. The initial point for soundings is a point marked zero at the left end of the bridge. The channel is slightly curved and somewhat irregular for 150 feet above the station. A wagon bridge spans the stream 50 feet above. The channel below the station is somewhat

wider and straight for 100 feet. The tailrace of an old mill enters the stream 100 feet below the station. Both banks are high, nearly free from timber or brush, and not subject to overflow. The bed of the stream is composed of small cobblestones and is permanent. There is but one channel at all stages, which is broken at high stages by the pile supports of the bridge. The bridge crosses the stream at about 15° from right angle, and points for soundings were laid off longer to correspond to the cosine of angle. The bench mark is a cut on the south corner of the stone abutment of the wagon bridge. Its elevation is 0.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements on Chalk Creek at Coalville, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
October 24	W. D. Beers	26	0.76	1.50	20
December 12	do	24	.79	1.50	20

Mean daily gage height, in feet, of Chalk Creek at Coalville, Utah, for 1904.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		1.50	1.60	12		1.25	1.50	22		1.55	
2		1.50	1.60	13		1.47	1.50	23	1.50	1.45	1.50
3		1.50	1.40	14		1.40		24	1.50	1.42	1.50
4		1.50	1.30	15		1.46		25	1.50	1.55	
5		1.50	1.30	16		1.49		26	1.50	1.55	
6		1.50	1.47	17		1.42	1.50	27	1.50	1.60	1.50
7		1.40	1.55	18		1.52		28	1.50	1.55	
8		1.43	1.40	19		1.51		29	1.50	1.35	
9		1.47	1.40	20		1.40	1.50	30	1.47	1.44	1.50
10		1.43	1.50	21		1.53	1.50	31	1.47		1.50
11		1.35	1.55								

JORDAN RIVER NEAR LEHI, UTAH.

This station was established May 30, 1904, by W. G. Swendsen. It is located at the highway bridge, about 800 feet below the pump house at the outlet of Utah Lake, near the town of Lehi, Utah. A staff gage, graduated to feet and tenths, is nailed vertically to a pier at the southeast corner of the bridge. It is read twice each day by W. A. Knight. Discharge measurements are made from a plank walk built across the stream upon cantilevers from the bridge to which the gage is attached. The initial point for soundings is two 10-penny nails driven close together in the east end of the plank. The channel is

straight for about 150 feet above and below the station. The current is sluggish. Both banks are high, clean, and not subject to overflow. The bed of the stream is composed of clay and is probably not permanent, since the channel may be cleaned or dredged out at any time by the canal company. Bench mark No. 1 is a nail in the top of pile at the east abutment of the bridge. Its elevation is 8.57 feet above the zero of the gage. Bench mark No. 2 is the head of the copper bolt of Utah Lake Compromise Monument. Its elevation is 10.50 feet above the zero of the gage.

There is practically no natural flow in Jordan River the greater part of the year, and in order to utilize the water of Utah Lake in irrigation work the water is raised by means of a dam and pumping station a short distance above the gaging station so as to make an artificial flow.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Jordan River near Lehi, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 28 [a]	W. Swendsen	252	1.62	3.95	410
May 30 [a]	do	252	1.62	3.95	416
June 14 [a]	H. S. Kleinschmidt	236	1.80	4.00	426
June 20 [a]	do	237	1.80	4.00	428
July 30 [a]	C. Tanner	245	1.68	3.92	412
October 13 [b]	W. D. Beers and E. F. Tabor.	214	1.40	3.27	301
October 13 [b]	do	214	1.37	3.27	293
October 13 [c]	do	195	1.02	2.95	200
October 14 [d]	do	149	.76	2.02	114
October 14 [d]	do	146	.76	1.97	110
October 15 [b]	do	216	1.41	3.30	305
December 23	W. Swendsen	81	.38	1.01	31

[a] 4 pumps running.
[b] 3 pumps running.
[c] Measurement uncertain on account of change in cross section of stream.
[d] 1 pump running.

Mean daily gage height, in feet, of Jordan River near Lehi, Utah, for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.10	3.95	3.95	3.85	3.35	0.80	0.90
2	.....	4.00	3.95	3.90	3.85	3.35	.80	.90
3	.....	4.05	3.95	(a)	3.85	3.30	.80	.90
4	.....	4.05	4.00	3.90	3.85	3.30	.80	.90
5	.....	4.00	3.95	3.90	3.85	3.35	.80	.90
6	.....	3.95	4.00	3.90	3.80	(a)	.80	.90
7	.....	4.05	3.95	3.67	3.85	(a)	.80	.90
8	.....	4.10	3.95	3.90	3.85	3.40	.80	.90
9	.....	3.95	3.95	3.90	3.85	3.35	.80	.90
10	.....	4.05	3.72	3.90	3.90	3.35	.85	.90
11	.....	4.05	3.95	3.90	3.80	3.30	.85	.90
12	.....	4.00	4.10	(a)	3.85	3.30	.85	.90
13	.....	4.00	4.00	(a)	3.90	3.35	.85	.90
14	.....	4.05	4.00	3.90	(a)	(b)	.85	.90
15	.....	4.00	4.00	3.85	3.85	.....	.85	.90
16	.....	3.95	3.90	3.90	3.85	.....	.85	.95
17	.....	4.00	3.95	3.90	3.80	.75	.85	.95
18	.....	3.95	3.95	3.85	3.75	.75	.90	.95
19	.....	3.70	3.95	3.85	3.85	.75	.90	.95
20	.....	3.95	3.90	3.95	3.80	.75	.90	1.00
21	.....	3.95	3.95	3.85	3.80	.75	.90	1.00
22	.....	4.05	4.00	3.85	3.75	.75	.90	1.00
23	.....	4.00	3.90	3.85	3.80	(b)	.90	1.00
24	.....	4.00	3.60	3.85	3.80	.....	.90	1.00
25	.....	4.00	(a)	3.85	3.80	.....	.90	1.00
26	.....	4.00	3.95	3.90	3.85	.....	.90	1.00
27	.....	4.00	3.95	3.85	3.90	.....	.90	1.00
28	.....	3.95	3.95	3.90	3.80	.....	.90	1.00
29	.....	4.00	4.00	3.75	3.80	.80	.90	1.00
30	3.95	3.95	3.90	3.85	3.40	.80	.90	1.00
31	3.95	.....	3.90	3.90	.....	.80	.....	1.15

a Discharge interpolated.

b Outlet gates shut down.

Rating table for Jordan River near Lehi, Utah, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.70	22	1.30	47	2.30	148	3.30	302
.75	23	1.40	55	2.40	161	3.40	320
.80	24	1.50	63	2.50	175	3.50	337
.85	25	1.60	71	2.60	189	3.60	354
.90	26	1.70	81	2.70	204	3.70	371
.95	28	1.80	91	2.80	219	3.80	388
1.00	30	1.90	101	2.90	235	3.90	406
1.05	33	2.00	111	3.00	252	4.00	423
1.10	36	2.10	122	3.10	268	4.10	440
1.20	41	2.20	135	3.20	285	4.20	456

The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1904. It is well defined between gage heights 1.00 foot and 4.00 feet. The table has been extended beyond these limits. Above gage height 3.00 feet the rating curve is a tangent, the difference being 17 per tenth.

Estimated monthly discharge of Jordan River near Lehi, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	414	250	304	18,090
June	440	371	422	25,110
July	440	354	410	25,210
August	414	367	402	24,720
September	406	320	392	23,330
October, 22 days	320	23	192	8,363
November	26	24	25.1	1,494
December	38	26	28.1	1,728
The period				128,000

Discharge, in acre-feet, of Jordan River and canal systems.

Month.	North Jordan.	East Jordan.	City.	South Jordan.	Utah and Salt Lake.	Jordan River weir.	Total flow of river.
April [a]	0	650		647	720	75	2,092
May	1,063	3,036	596	5,167	4,150	2,911	16,920
June	3,061	5,701	452	6,648	7,878	4,225	27,960
July	3,425	5,369	3,199	5,407	6,719	3,894	28,010
August	3,367	5,186	3,090	5,031	7,110	3,668	27,450
September	2,766	5,280	1,373	5,357	7,992	2,767	25,540
October [b]	753	1,920	399	2,134	3,367	319	8,883
Total	14,440	27,140	9,109	30,390	37,940	17,850	136,900

[a] Flow started April 23.

[b] Pumps were shut down October 15.

AMERICAN FORK NEAR AMERICAN FORK, UTAH.

This station was established May 21, 1900, by C. C. Babb. It is located about 6 miles northeast of the town of American Fork, Utah, 50 feet north of the county road, and 200 feet southwest of the power house of the electrical company. Measurements are made over a sharp crested, rectangular weir. A nail driven into the weir structure, just south of the south opening and level with the crest of the weir, serves to determine gage heights. The observer is Peter Anderson. During floods considerable gravel runs in the stream and is deposited just above the weir, making measurement at such times erroneous. When this difficulty becomes pronounced, several planks in the dam are raised and the gravel is sluiced out.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Mean daily gage height, in feet, of American Fork near American Fork, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.27	.....	0.27	.....	0.88	.....	1.05	0.58	0.46	0.48	0.46	0.41
2	.27	0.28	.27	.....	.82	.....	1.04	.58	.45	.47	.45	.41
3	.27	.28	.27	0.35	.78	.....	1.02	.58	.45	.47	.45	.40
4	.27	.28	.27	.35	.83	.....	1.00	.57	.44	.47	.44	.40
5	.27	.27	.27	.35	.87	.....	.98	.56	.44	.47	.44	.36
6	.27	.28	.26	.36	.95	.....	.96	.55	.44	.48	.44	.37
7	.28	.27	.27	.36	1.00	.....	.94	.53	.44	.48	.44	.37
8	.28	.27	.30	.37	1.01	.....	.90	.53	.43	.48	.44	.37
9	.28	.27	.32	.38	.99	.....	.87	.53	.43	.48	.44	.37
10	.28	.27	.32	.....	1.09	.....	.87	.53	.43	.47	.41	.37
11	.28	.27	.32	.....	1.19	.....	.83	.53	.43	.47	.44	.37
12	.28	.27	.31	.....	1.22	.....	.83	.53	.43	.53	.41	.37
13	.29	.27	.31	.....	1.25	.....	.80	.60	.43	.49	.43	.38
14	.29	.27	.31	.....	1.28	1.22	.78	.56	.43	.51	.42	.39
15	.....	.27	.31	.....	1.30	1.17	.78	.56	.42	.50	.41	.40
16	.29	.27	.31	.....	1.44	1.22	.73	.56	.42	.50	.42	.40
17	.29	.27	.....	.....	1.42	1.24	.74	.56	.42	.50	.41	.38
18	.29	.27	.32	.....	1.45	1.22	.69	.55	.42	.49	.41	.38
19	.29	.27	.32	.....	1.48	1.22	.68	.53	.42	.49	.41	.39
20	.29	.27	.32	.....	1.39	1.24	.67	.53	.46	.47	.41	.39
21	.29	.27	.33	.....	1.24	1.17	.66	.51	.47	.47	.41	.39
22	.29	.27	.33	.....	1.30	1.16	.66	.48	.47	.47	.41	.40
23	.29	.28	.32	.....	1.39	1.09	.65	.47	.47	.47	.41	.40
24	.....	.28	.32	.60	1.71	1.03	.64	.48	.47	.47	.41	.40
25	.27	.28	.32	.62	2.01	.97	.63	.48	.48	.47	.41	.39
26	.27	.28	.32	.65	.....	.99	.61	.48	.49	.47	.41	.36
27	.28	.28	.32	.68	.....	1.03	.61	.48	.49	.47	.41	.30
28	.28	.28	.....	.74	.....	1.05	.61	.48	.49	.47	.41	.38
29	.28	.28	.37	.80	.....	1.04	.62	.48	.49	.46	.41	.38
30	.28	.....	.37	.86	.....	1.05	.61	.47	.48	.46	.41	.39
31	.28	.....	.36	.....	.....	.....	.61	.47	.....	.46	.....	.39

NOTE.—Total width of weir, April 15 to September 20 = 42 feet (10 end contractions). Remainder of year = 33 feet (10 end contractions).

Mean daily discharge, in second-feet, of American Fork near American Fork, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	15	a 16	15	a 23	113	a 310	147	61	43	36	34	28
2	15	16	15	a 23	102	a 301	145	61	42	35	33	28
3	15	16	15	23	95	a 291	141	61	42	35	33	27
4	15	16	15	23	104	a 281	137	59	40	35	32	27
5	15	15	15	23	111	a 271	133	58	40	35	32	23
6	15	16	15	23	127	a 261	129	56	40	36	32	24
7	16	15	15	23	137	a 252	125	53	40	36	32	24
8	16	15	18	24	139	a 242	117	53	39	36	32	24
9	16	15	20	25	135	a 232	111	53	39	36	32	24
10	16	15	20	a 28	155	a 222	111	53	39	35	32	24
11	16	15	20	a 30	176	a 212	104	53	39	35	32	24
12	16	15	19	a 33	183	a 203	104	53	39	41	32	24
13	17	15	19	a 35	190	193	98	64	39	37	31	25
14	17	15	19	a 38	196	183	95	58	39	39	30	26
15	a 17	a 15	19	a 41	201	172	95	58	38	38	28	27
16	17	15	19	a 43	233	183	86	58	38	38	30	27
17	17	15	a 19	a 46	229	187	87	58	38	38	28	25
18	17	15	20	a 48	236	183	79	56	38	37	28	25
19	17	15	20	a 51	243	183	77	53	38	37	28	26
20	17	15	20	a 54	222	187	75	53	34	35	28	26
21	17	15	21	a 56	187	172	74	50	35	35	28	26
22	17	15	21	a 59	201	170	74	46	35	35	28	27
23	17	16	20	a 61	222	155	72	44	35	35	28	27
24	a 16	16	20	64	299	143	71	46	35	35	28	27
25	15	16	20	67	379	131	69	46	36	35	28	26
26	15	16	20	72	a 369	135	66	46	37	35	28	23
27	16	16	20	77	a 359	143	66	46	37	35	28	18
28	16	16	a 22	87	a 350	147	66	46	37	35	28	25
29	16	16	24	98	a 340	145	67	46	37	34	28	25
30	16	.....	24	109	a 330	147	66	44	36	34	28	26
31	16	.....	23	.....	a 320	.....	66	44	.....	34	.....	26

a Discharge estimated.

Estimated monthly discharge of American Fork near American Fork, Utah, for 1903.

[Drainage area, 66 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
April 6-30	111	27	52.7	2,613	.798	.742
May	208	69	122	7,501	1.85	2.13
June	280	133	213	12,670	3.23	3.60
July	125	42	73.2	4,501	1.11	1.28
August	43	27	34.5	2,121	.523	.603
September	33	26	27.9	1,660	.423	.472
October	34	22	26.4	1,623	.400	.461
November	25	20	21.4	1,273	.324	.362
December	21	16	18.6	1,144	.282	.325
The Period	.....	.....	.....	35,110	.....	.....

NOTE.—Missing gage heights interpolated.

Estimated monthly discharge of American Fork near American Fork, Utah, for 1904.

[Drainage area, 66 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.			Rainfall in inches.[a]
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.	Per cent of rainfall.	
January	17	15	16.1	990	0.244	0.281	14.7	1.91
February	16	15	15.4	886	.233	.251	9.5	2.64
March	24	15	19.1	1,174	.289	.333	9.2	3.62
April	109	23	46.9	2,791	.711	.793	63	1.26
May	379	95	216	13,280	3.27	3.77	183	2.06
June	310	131	201	11,960	3.05	3.40	596	.57
July	147	66	95.3	5,860	1.44	1.66	488	.34
August	64	44	52.8	3,247	.800	.922	140	.66
September	43	35	38.1	2,267	.577	.644	644	.10
October	41	34	35.9	2,207	.544	.627	45.1	1.39
November	34	28	30.0	1,785	.454	.507	.....	.00
December	28	18	25.3	1,556	.383	.442	29.8	1.48
The year	379	15	66.0	48,000	1.00	13.62	85.0	16.03

[a] Mean at Provo and Heber.

PROVO RIVER AT MOUTH OF CANYON, NEAR PROVO, UTAH.

This station was established July 27, 1889, by Samuel Fortier. It is located about 6 miles north of Provo, about 1,000 feet above Olmsted Station, on the Denver and Rio Grande Railroad, and 1,200 feet above the power house of the Telluride Power Company, and above the head of most of the irrigation canals of Utah Valley. The diversion works of the company, which develop power at the mouth of Provo Canyon for electric transmission to the mines west of Provo, are located about 5 miles above the station. The Heber branch of the Denver and Rio Grande Railway passes within 20 feet of the new gage rod. The station is one-eighth mile above the county bridge. The old gage is an inclined rod set on the left bank. The new gage is a vertical aspen stick set on the right bank 90 feet northeast of the old gage. Both gages read 4.80 feet when the new gage was installed, but the zero of the new gage is 0.10 foot above the zero of the old gage. During 1904 the gage was read twice each day by E. A. Briscoe. Discharge measurements are made by means of a cable and car located at the gage. Instead of using a tagged wire, the cable has been marked with white paint every 3 feet. The initial point for soundings is the first white

mark on the cable south of the vertical post which supports the cable on the right bank. The channel is straight for 200 feet above and for 100 feet below the station. The right bank is steep and rocky and has an elevation of about 10 feet above the zero of the gage. The left bank is sloping and has an elevation of about 7 feet above the zero of the gage. It is liable to overflow at flood stages. The bed of the stream is composed of bowlders and is permanent. The current is swift, and at flood stages has a velocity that is too high for accurate measurement. There is one channel up to the point where the river overflows the left bank. Above this stage there are two channels. Bench mark No. 1 is a cross chiseled in a limestone rock about 1 foot square, which bears south 15° E. and is 100 feet distant from the old gage. Its elevation is 6.98 feet above the zero of the old (inclined) gage. The letters "B. M." are chiseled in the rock. Bench mark No. 2 is a United States Geological Survey standard bench mark plate cemented into the top of the south abutment of the highway bridge one-eighth mile southwest of the station. Its elevation is 4.75 feet above the zero of the gage. Bench mark No. 3 bears north 7° 45′ west 126 feet from the north post of the station. It is a cross chiseled on top of a bowlder projecting about 1 foot above the ground. Its elevation is 11.21 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Provo River at mouth of canyon, near Provo, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
January 5	C. Tanner	115	2.48	4.50	285
February 10	do	93	2.07	4.22	192
March 12	do	132	2.72	4.65	358
March 23	W. P. Hardesty	128	3.09	4.70	395
April 16	C. Tanner	170	3.63	5.15	617
May 19	do	253	5.50	6.25	1,390
June 15	H. S. Kleinschmidt	251	5.37	6.25	1,365
June 18	do	200	5.27	5.70	1,058
July 12	do	95	2.50	4.30	237
July 12	do	101	2.47	4.30	244
July 26	do	81	2.31	4.04	187
October 31	W. Swendsen	76	2.06	4.00	156
December 7	do	52	1.76	3.92	91
December 20	do	61	1.79	3.98	109

Mean daily gage height, in feet, of Provo River at mouth of canyon, near Provo, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.40	4.55	4.73	4.71	[a] 4.88	6.30	4.59	4.09	3.99	3.74	3.98	4.12
2	4.40	4.40	4.81	4.66	4.87	6.28	4.53	4.02	4.02	3.70	3.97	4.20
3	4.40	4.40	4.75	4.70	4.95	6.58	4.48	4.00	4.08	3.76	4.00	4.02
4	4.40	4.40	4.63	4.77	5.17	6.30	4.43	4.00	4.01	3.78	3.98	4.05
5	4.40	4.45	4.65	4.71	4.97	6.33	4.46	4.03	3.99	3.84	3.95	4.00
6	4.40	[a] 4.45	[a] 4.65	4.68	4.99	6.22	4.54	4.00	4.02	3.80	3.96	3.90
7	4.40	[a] 4.40	4.66	4.66	5.00	6.09	4.47	4.03	3.99	3.85	3.94	3.95
8	4.40	4.40	4.73	4.65	5.04	6.36	4.47	4.01	4.01	3.80	3.90	4.00
9	4.40	4.45	4.96	4.67	5.09	6.43	4.27	4.07	4.00	3.89	3.97	3.95
10	4.40	4.40	4.79	4.69	5.39	6.46	4.28	4.01	3.98	3.94	3.98	4.00
11	4.40	4.46	4.84	4.79	5.53	6.49	4.23	4.01	4.00	3.82	3.95	4.02
12	4.45	4.51	4.65	4.89	5.64	6.54	4.21	4.04	3.99	3.90	3.92	4.10
13	4.47	4.52	4.61	4.95	5.69	6.51	4.18	4.04	4.18	3.86	3.99	4.10
14	4.50	4.49	4.60	5.07	5.74	6.51	4.18	4.07	3.73	3.86	4.02	4.08
15	4.30	4.49	4.69	5.10	5.84	6.29	4.02	4.17	3.74	3.90	4.00	4.09
16	4.30	4.62	4.67	5.17	5.92	6.00	4.13	4.16	3.71	4.00	4.00	4.10
17	[a] 4.32	4.65	4.63	5.00	5.98	5.97	4.12	4.11	3.77	4.04	4.00	4.10
18	4.35	4.53	4.64	5.07	6.15	5.84	4.00	4.10	3.83	3.92	4.17	4.00
19	4.22	4.52	4.64	5.02	6.37	[a] 4.84	4.10	4.09	3.81	3.96	4.00	4.02
20	4.27	4.56	4.71	5.25	6.21	5.85	4.09	4.11	3.85	3.90	4.10	3.95
21	4.22	4.59	4.69	5.24	6.15	5.81	4.11	4.08	3.89	3.97	4.00	4.00
22	4.30	4.70	4.63	5.10	6.25	5.50	4.11	4.05	3.86	3.92	4.00	4.10
23	4.30	5.28	4.65	5.05	6.44	5.40	4.09	4.03	3.89	3.92	4.01	4.11
24	4.45	5.29	4.67	4.88	6.80	5.23	4.25	4.00	3.89	3.97	4.00	4.12
25	4.45	5.53	4.67	4.95	7.26	5.12	4.18	4.05	[a] 3.89	3.95	4.05	4.10
26	4.35	5.38	4.64	4.93	7.23	5.01	4.10	4.05	3.89	3.96	4.07	3.98
27	4.40	4.97	4.60	4.96	7.13	4.96	4.07	4.03	3.86	3.95	4.10	4.05
28	4.35	4.90	4.62	5.03	6.86	4.85	4.21	4.03	3.85	3.97	4.20	4.08
29	4.40	4.77	5.23	5.01	6.49	4.77	4.06	4.08	3.75	3.97	4.05	3.98
30	4.40	.....	5.02	4.98	6.40	4.69	4.07	4.05	3.71	3.96	4.05	3.92
31	4.40	.....	4.83	.....	6.35	.....	4.02	3.99	.....	3.94	.....	4.25

[a] Interpolated.

Rating table for Provo River at mouth of canyon, near Provo, Utah, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.60	68	4.30	220	5.40	775	6.40	1,490
3.65	73	4.40	253	5.50	841	6.50	1,565
3.70	79	4.50	290	5.60	910	6.60	1,640
3.75	86	4.60	331	5.70	980	6.70	1,715
3.80	94	4.70	376	5.80	1,050	6.80	1,790
3.85	103	4.80	425	5.90	1,120	6.90	1,865
3.90	113	4.90	477	6.00	1,192	7.00	1,945
3.95	124	5.00	532	6.10	1,265	7.10	2,025
4.00	136	5.10	589	6.20	1,340	7.20	2,105
4.10	162	5.20	649	6.30	1,415	7.30	2,185
4.20	190	5.30	711				

The above table is applicable only for open-channel conditions. It is based upon 17 discharge measurements made during 1903 and 1904. It is well defined between gage heights 4 feet and 6.25 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Provo River at mouth of canyon near Provo, Utah, for 1904.

[Drainage area, 640 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.			Rainfall in inches.[a]
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.	Per cent of rainfall.	
January	290	196	244	15,000	0.381	0.439	23	1.91
February	861	253	373	21,460	.583	.629	24	2.64
March	667	331	388	23,860	.606	.699	19	3.62
April	680	353	486	28,920	.759	.847	67	1.26
May	2,153	461	1,145	70,410	1.79	2.06	100	2.06
June	1,625	371	1,131	67,300	1.77	1.98	347	.57
July	326	136	202	12,420	.316	.364	107	.34
August	182	134	149	9,162	.233	.269	41	.66
September	184	80	117	6,962	.183	.204	204	.10
October	146	79	113	6,948	.177	.204	15	1.39
November	190	113	139	8,271	.217	.242	.....	0.00
December	205	113	149	9,162	.233	.269	18	1.48
The year	2,153	79	386	279,900	.604	8.20	51	16.03

[a] Mean at Provo and Heber.

Estimated monthly discharge of Telluride Power Company's flume near Provo, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 15–31[a]	65	0	42.7	1,440
June	85	20	38.5	2,291
July	76	0	53.9	3,314
August	82	36	61.1	3,757
September	90	32	58.4	3,475
October	81	58	71.6	4,403
November	77	48	63.0	3,749
December	81	31	56.0	3,443
The period	.....	.....	.....	25,870

[a] Flow began May 15.

NOTE.—To get total flow of Provo River at head of diversion dams, the flume discharge should be added to that of the gaging station given above.

PROVO RIVER AT SAN PEDRO, LOS ANGELES AND SALT LAKE RAILROAD BRIDGE, NEAR PROVO, UTAH.

This station was established May 24, 1903, by C. Tanner. It is located at the San Pedro, Los Angeles and Salt Lake Railroad bridge, one-half mile from Provo, Utah. The Rio Grande Western Railway bridge is about 300 feet east of the station. The gage is a vertical rod fastened to a cottonwood post, which is set in the bed of the river near the left or south bank. The top of the post is spiked to a stringer of the bridge. The gage is read once each day by Lars Thomson. Discharge measurements at high water are made from the railroad bridge, to which the gage is attached. At low stages measurements are made by wading. The initial point for soundings is the north face of the left or south abutment. The channel is straight for 175 feet above and for 300 feet below the station. The current is swift. There are two channels at low water and one channel at high water. Both banks have an elevation of about 8 feet above the river bed, and will overflow only at extreme flood stages. The bed of the stream is composed of gravel and cobblestones and is somewhat shifting. Bench mark No. 1 is a United States Geological Survey standard bench mark set in cement on the top of the south abutment of the bridge, to which the gage is attached. Its elevation is 6.68 feet above the zero of the gage. Bench mark No. 2 is a cross cut in the top of the parapet wall of the south abutment of the Denver and Rio Grande Railroad bridge, 275 feet upstream from the gaging station. Its elevation is 11.26 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Provo River at S. P., L. A. and S. L. R. R. bridge, near Provo, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Feet per sec.*	*Feet.*	*Second-feet.*
January 15	C. Tanner	49	2.97	0.96	146
February 12	do	75	2.55	1.06	190
February 23	do	136	3.63	1.75	493
March 13	do	78	3.36	1.20	263
March 24	W. P. Hardesty	80	3.39	1.32	271
April 25	C. Tanner	99	3.82	1.50	380
May 21	W. Swendsen	156	5.11	2.19	795
June 2	do	230	4.45	2.42	1,026
June 15	H. S. Kleinschmidt	172	4.72	2.35	810
June 18	do	156	4.56	2.08	703
October 31	W. Swendsen	21	3.04	—.10	65
December 3	do	40	2.47	.40	99
December 21	do	45	3.42	.75	153

Mean daily gage height, in feet, of Provo River at S. P., L. A. and S. L. R. R. bridge, near Provo, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.92	0.93	1.36	1.36	1.42	2.60
2	.....	.....	1.38	1.32	1.40	2.60
3	.....	1.04	1.30	1.30	1.46	2.70
4	.....	.....	1.28	1.34	1.44	2.30
5	.92	1.08	1.26	1.36	1.40	2.30
6	.....	.....	1.24	1.32	1.48	2.20
7	.....	1.04	1.30	1.30	1.54	2.36
8	.....	.....	1.30	1.34	1.50	2.50
9	.90	1.02	1.32	1.26	1.52	2.40
10	.....	.....	1.32	1.30	1.60	2.42
11	1.00	1.03	1.38	1.30	1.70	2.50
12	.....	1.06	1.30	1.40	1.96	2.60
13	.....	.....	1.28	1.40	2.00	2.54
14	.99	.98	1.22	1.44	2.10	2.45
15	1.00	.....	1.24	1.54	2.16	2.30
16	.....	1.38	1.20	1.50	2.24	2.26
17	.....	1.37	1.20	1.52	2.24	2.20
18	1.00	1.08	1.30	1.44	2.30	2.00
19	.....	1.08	1.32	1.46	2.40	1.96
20	1.00	1.10	1.30	1.50	2.40	1.84
21	.....	1.14	1.34	1.54	2.36	1.64
22	1.00	1.42	1.38	1.50	2.34	1.60
23	.....	1.80	1.32	1.52	2.50	1.50
24	.94	1.68	1.36	1.48	2.90	1.46
25	.....	2.10	1.36	1.50	3.20	1.00
26	.97	1.50	1.38	1.58	3.26	1.00
27	.....	1.36	1.36	1.70	3.30	.80
28	.96	1.22	1.34	1.74	3.00	(a)
29	.....	1.39	1.64	1.70	2.70	.....
30	1.10	.....	1.50	1.40	2.66	.....
31	.....	.....	1.40	.....	2.50	.....

a Stream dry.

Rating table for Provo River at S. P., L. A. and S. L. R. R. bridge, near Provo, Utah, from January 1 to June 5, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.90	130	1.60	433	2.20	805	2.80	1,247
1.00	160	1.70	488	2.30	879	2.90	1,321
1.10	196	1.80	544	2.40	953	3.00	1,395
1.20	235	1.90	605	2.50	1,027	3.10	1,469
1.30	279	2.00	667	2.60	1,100	3.20	1,543
1.40	328	2.10	731	2.70	1,173	3.30	1,617
1.50	380						

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during January to June 5, 1904. It is well defined between gage heights 0.90 foot and 2.20 feet. The table has been extended beyond these limits. Above gage heights 2.20 feet the rating curve is a tangent, the difference being 74 per tenth.

Rating table for Provo River at S. P., L. A. and S. L. R. R. bridge near Provo, Utah, from June 6 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.00	65	0.70	144	1.40	414	2.10	708
0.10	70	0.80	170	1.50	456	2.20	750
0.20	78	0.90	204	1.60	498	2.30	792
0.30	87	1.00	246	1.70	540	2.40	834
0.40	96	1.10	288	1.80	582	2.50	876
0.50	108	1.20	330	1.90	624	2.60	918
0.60	123	1.30	372	2.00	666	2.70	960

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during June to December, 1904. It is well defined between gage heights 0.10 foot and 2.60 feet. The table has been extended beyond these limits. Above gage height 0.90 foot the rating curve is a tangent, the difference being 42 per tenth.

Estimated monthly discharge of Provo River at S. P., L. A. and S. L. R. R. bridge near Provo, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]	196	130	146	8,977
February [a]	731	139	253	14,550
March	455	235	294	18,080
April	510	279	353	21,000
May	1,617	328	810	49,800
June 1–28 [b]	1,173	0	653	38,860
July	0	0	0	0
August	0	0	0	0
September	0	0	0	0
October				[c] 1,782
November				4,990
December				8,494
The year				166,500

[a] Discharge interpolated for missing gage heights.
[b] Stream dry June 28 to October 15.
[c] Estimated October 15, when flow began, to December 31 from meter measurements.

HOBBLE CREEK NEAR SPRINGVILLE, UTAH.

This station was established March 23, 1904, by C. Tanner. It is located about 1 mile above the mouth of the canyon, about 4 miles southeast of Springville, Utah. It is about 600 feet northeast of the head of the Mapleton canal and about 1,200 feet southwest of the power house of the Springville Electric Lighting plant. A staff gage, graduated to feet and tenths, is driven into the bed of the stream and braced to an overhanging tree. It is read daily by F. N. West. Discharge measurements are made by wading near the gage. The initial point for soundings is a 2 by 4 inch post driven into the south bank, marked with pencil. At 24.3 feet on the north bank a tree is blazed and marked "24.3." The channel is straight for 75 feet above and 50 feet below the station. The current is fairly swift. The right bank is low, wooded, and liable to overflow during high water. The right bank is high and wooded. The bed of the stream is composed of clean sand and gravel and is somewhat shifting. There is but one channel at all stages. Bench mark No. 1 is a nail in the top of the post which marks the initial point for soundings. Its elevation is 4.91 feet above the zero of the gage. Bench mark No. 2 is a nail in a post set 26 feet south of the initial point for soundings. Its elevation is 12.38 feet above the zero of the gage. Bench mark No. 3 is a 30-penny nail in the east side of a pole of the electric transmission line 97 feet northwest of the initial point for soundings. Its elevation is 21.80 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Hobble Creek near Springville, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 18	C. Tanner	17	1.13	1.26	20
March 28	W. P. Hardesty	20	1.24	1.34	25
April 18	E. C. Murphy and C. Tanner.	42	2.80	2.90	117
May 20	C. Tanner	35	3.30	2.85	114
May 20	W. Swendsen	36	3.72	2.85	124
June 1	do	21	3.80	2.05	78
June 17	H. S. Kleinschmidt	19	3.53	1.85	68
July 19	do	10	2.17	1.40	23
September 15	C. Tanner	7.7	1.78	1.27	14
September 15	do	9	1.60	1.27	15
October 30	W. Swendsen	12	1.46	1.35	17
December 2	do	10	1.23	1.32	13
December 21	do	9.7	1.75	1.35	17

Mean daily gage height, in feet, of Hobble Creek near Springville, Utah, for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1	.....	1.75	3.00	2.15	(a)	17	.....	3.00	3.02	1.70	.....
2	.....	1.72	2.95	2.05	.....	18	.....	2.90	2.92	1.70	.....
3	.....	1.77	3.15	2.00	.....	19	.....	3.00	2.80	1.70	.....
4	.....	1.82	3.35	1.95	.....	20	.....	3.00	2.65	1.60	.....
5	.....	1.95	3.80	1.95	.....	21	.....	.....	2.55	1.65	.....
6	.....	1.90	4.10	1.90	.....	22	.....	2.70	.....	1.60	.....
7	.....	1.80	4.00	1.80	.....	23	1.57	2.50	2.70	1.50	.....
8	.....	1.85	3.75	1.70	.....	24	1.35	2.35	2.75	1.40	.....
9	.....	1.90	3.55	1.70	.....	25	1.45	2.35	2.80	1.30	.....
10	.....	2.00	3.40	1.70	.....	26	1.45	2.50	2.90	1.30	.....
11	.....	2.20	3.55	1.70	.....	27	1.50	2.90	2.85	1.25	.....
12	.....	2.60	3.45	1.65	.....	28	1.57	3.10	2.60	1.25	.....
13	.....	2.85	3.40	1.70	.....	29	1.82	3.00	2.45	1.25	.....
14	.....	3.20	3.35	1.75	.....	30	1.85	3.05	2.35	1.25	.....
15	.....	3.30	3.30	1.75	.....	31	1.79	.....	2.20	.....	.....
16	.....	3.30	3.20	1.70	.....						

[a] Observer discontinued gage reading.

Rating table for Hobble Creek near Springville, Utah, from January 1 to May 26, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	17	1.70	46	2.40	88	3.30	141
1.25	19	1.75	49	2.50	94	3.40	147
1.30	22	1.80	52	2.60	100	3.50	153
1.35	25	1.85	55	2.70	106	3.60	159
1.40	28	1.90	58	2.80	112	3.70	165
1.45	31	2.00	64	2.90	118	3.80	171
1.50	34	2.10	70	3.00	123	3.90	177
1.55	37	2.20	76	3.10	129	4.00	182
1.60	40	2.30	82	3.20	135	4.10	188
1.65	43						

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during March 18 to May 20, 1904. It is not well defined. The rating curve is a tangent, the difference being 6 per tenth. Indication of channel changing about May 26, 1904.

Rating table for Hobble Creek near Springville, Utah, from May 27 to November 26, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	5	1.80	59	2.40	113	2.90	158
1.30	14	1.90	68	2.50	122	3.00	167
1.40	23	2.00	77	2.60	131	3.10	176
1.50	32	2.10	86	2.70	140	3.20	185
1.60	41	2.20	95	2.80	149	3.30	194
1.70	50	2.30	104				

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during June 1 to December 21, 1904. It is not well defined. The rating curve is a tangent, the difference being 9 per tenth. Indication of channel changing about May 26, 1904.

Estimated monthly discharge of Hobble Creek near Springville, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March	55	25	39.7	709
April	141	47	93.9	5,587
May	188	95	133	8,178
June	90	10	45.8	2,725
July[a]				1,960
August				1,220
September				950
October				1,090
November				950
December				980
The period				24,340

[a] Observer on July 1 discontinued gage reading, and read depth of water in cross section. Discharge for July to December, inclusive, was estimated from meter measurements and the depth of water in section.

SPANISH FORK NEAR SPANISH FORK, UTAH.

This station was originally established May 23, 1900, by C. C. Babb. It was reestablished March 26, 1903, by C. Tanner. It is located 600 feet above the dam of the East Bench Irrigation Company and 5 miles southeast of Spanish Fork, Utah. The Rio Grande Western Railroad track is about 300 feet northeast of the gage. The gage is a 1 by 4 inch redwood stick 4½ feet long. It is driven firmly in the bed of the river and is well braced. It is graduated to feet, tenths, and fiftieths, and located near the right bank about 1 foot from the water's edge. It is read once each day by Levi Thorpe. Discharge measurements are made by wading. The initial point for soundings is a willow stake on the right bank 2 feet northeast of the gage. The channel is straight for 150 feet above and below the station and the current is swift. The right bank is about 4 feet above the bed of the stream. It is covered with a dense growth of willows and is not liable to overflow. The left bank is about 5½ feet above the bed of the stream. It is also covered with willows. The bed of the stream is composed of coarse gravel and sand, somewhat shifting. The change in the cross section takes place principally in the right half. There is but one channel at all stages. The bench mark is a cross on a limestone rock, which bears south 36° east, and is 29 feet distant from the gage. On the south face of the rock are the letters "U. S. G. S." in black paint. Its elevation is 7.16 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Spanish Fork near Spanish Fork, Utah, in 1904.

Date	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
February 9	C. Tanner	28	2.40	1.50	66
March 14	do	28	2.62	1.54	75
March 26	W. P. Hardesty	30	2.61	1.58	79
April 18	C. Tanner	54	3.72	2.30	201
June 16	H. S. Kleinschmidt	42	3.31	1.88	142
July 20	do	32	3.23	1.50	102
September 15	C. Tanner	27	2.43	1.40	66
October 30	W. Swendsen	30	2.33	1.40	69
December 2	do	27	2.41	1.40	64
December 22	do	26	2.50	1.47	65

Mean daily gage height, in feet, of Spanish Fork near Spanish Fork, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.56	1.68	1.58	1.82	2.48	2.46	1.76	1.54	1.44	1.40	1.42	1.42
2	1.64	1.70	1.58	1.80	2.48	2.36	1.70	1.50	1.44	1.40	1.42	1.42
3	1.50	1.70	1.50	1.80	2.66	2.52	1.68	1.48	1.42	1.40	1.42	1.42
4	1.46	1.50	1.58	2.30	2.76	2.44	1.70	1.44	1.42	1.40	1.42	1.22
5	1.46	1.48	1.50	1.92	2.78	2.34	1.66	1.44	1.42	1.40	1.42	1.48
6	1.46	1.50	1.54	1.82	3.01	2.26	1.64	1.42	1.40	1.40	1.42	1.48
7	1.58	1.48	1.56	1.78	2.96	2.36	1.72	1.46	1.40	1.40	1.42	1.48
8	1.70	1.58	1.60	1.80	2.94	2.30	1.68	1.40	1.40	1.40	1.42	1.20
9	1.80	1.48	1.66	1.80	2.94	2.20	1.64	1.42	1.40	1.40	1.42	1.44
10	1.80	1.50	1.50	1.90	3.00	2.08	1.66	1.42	1.40	1.42	1.42	1.32
11	1.60	1.50	1.58	2.20	3.14	2.04	1.60	1.44	1.40	1.38	1.28	1.26
12	1.54	1.50	1.54	2.12	3.22	2.02	1.60	1.54	1.40	1.42	1.26	1.24
13	1.52	1.50	1.46	2.24	3.28	2.00	1.60	1.46	1.38	1.42	1.26	1.32
14	1.58	1.42	1.54	2.24	3.28	1.96	1.56	1.58	1.38	1.42	1.24	1.39
15	1.42	1.50	1.54	2.42	3.28	1.94	1.52	1.48	1.40	1.42	1.38	1.36
16	1.42	1.52	1.56	2.26	3.36	1.92	1.54	1.48	1.42	1.42	1.38	1.24
17	1.42	1.54	1.54	2.26	3.34	1.90	1.54	1.52	1.46	1.42	1.32	1.56
18	1.48	1.50	1.54	2.32	3.32	1.90	1.52	1.48	1.42	[a] 1.41	1.38	1.32
19	1.64	1.56	1.58	2.36	3.26	1.88	1.52	1.44	1.40	1.40	1.44	1.32
20	1.44	1.48	1.56	2.44	3.14	1.84	1.52	1.44	1.38	1.40	1.32	1.30
21	1.68	1.52	1.56	2.40	2.98	1.80	1.50	1.44	1.40	1.40	1.34	1.30
22	1.50	1.56	1.46	2.24	2.96	1.76	1.50	1.44	1.40	1.40	1.34	1.38
23	1.46	1.88	1.60	2.18	2.96	1.74	1.50	1.44	1.40	1.40	1.32	1.38
24	1.46	1.78	1.60	2.10	2.96	1.72	1.68	1.46	1.40	1.40	1.30	1.40
25	1.46	1.74	1.62	2.12	3.34	1.70	1.58	1.46	1.40	1.40	1.30	1.40
26	1.56	1.70	1.46	2.10	3.30	1.70	1.52	1.44	1.40	1.42	1.32	1.32
27	1.80	1.60	1.58	2.34	3.04	1.70	1.52	1.46	1.42	1.42	1.34	1.24
28	1.64	1.72	1.60	2.40	2.90	1.70	1.60	1.50	1.42	1.42	1.34	1.24
29	1.68	1.54	2.50	2.42	2.70	1.70	1.56	1.48	1.42	1.42	1.30	1.49
30	1.48	.....	2.12	2.40	2.66	1.72	1.58	1.54	1.42	1.42	1.26	1.26
31	1.68	.....	1.92	.....	2.54	.....	1.58	1.46	.....	1.42	.....	1.30

[a] Interpolated.

Rating table for Spanish Fork near Spanish Fork, Utah, from January 1 to May 16 and from December 10 to December 31, 1904. [a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	36	1.60	82	2.00	146	2.80	300
1.25	40	1.65	89	2.10	164	2.90	320
1.30	45	1.70	97	2.20	183	3.00	340
1.35	50	1.75	105	2.30	202	3.10	361
1.40	56	1.80	113	2.40	221	3.20	382
1.45	62	1.85	121	2.50	240	3.30	403
1.50	68	1.90	129	2.60	260	3.40	424
1.55	75	1.95	137	2.70	280		

[a] Two rating tables necessary for 1904 on account of changes in channel during May and November.

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during spring and 1 measurement made in December, 1904. It is fairly well defined between gage heights 1.40 and 2.30 feet. The table has been extended beyond these limits.

Rating table for Spanish Fork near Spanish Fork, Utah, from May 17 to December 9, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	45	1.60	95	2.00	161	2.80	308
1.25	50	1.65	103	2.10	179	2.90	327
1.30	55	1.70	111	2.20	197	3.00	346
1.35	61	1.75	119	2.30	215	3.10	365
1.40	67	1.80	127	2.40	233	3.20	384
1.45	73	1.85	135	2.50	251	3.30	404
1.50	80	1.90	144	2.60	270	3.40	424
1.55	87	1.95	152	2.70	289		

[a] Two rating tables necessary for 1904 on account of changes in channel during May and November.

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during summer and fall of 1904. It is fairly well defined between gage heights 1.40 and 1.90 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Spanish Fork near Spanish Fork, Utah, for 1904.

[Drainage area, 670 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.			Rainfall in inches.[a]
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.	Per cent of rainfall.	
January	113	58	77.6	4,771	0.116	0.134	8.1	1.66
February	126	58	79.1	4,550	.118	.127	7.4	1.71
March	240	63	85.8	5,276	.128	.148	4.4	3.36
April	229	110	174	10,350	.260	.290	28	1.02
May	415	236	343	21,090	.512	.590	25	2.33
June	255	111	162	9,640	.242	.270	41	.66
July	121	80	94.6	5,817	.141	.163	39	.42
August	92	67	75.8	4,661	.113	.130	19	.69
September	75	65	68.0	4,046	.101	.113	13	.85
October	69	65	67.8	4,169	.101	.116	11	1.01
November	72	49	61.5	3,660	.092	.103	.....	.00
December	77	40	54.3	3,339	.081	.093	8.7	1.07
The year	415	40	112	81,370	.167	2.28	15.4	14.78

[a] Mean at Provo, Thistle and Soldiers Summit.

SPANISH FORK NEAR LAKE SHORE, UTAH.

This station was established December 10, 1903, by Caleb Tanner. It is located at the bridge on the highway between Spanish Fork and Lake Shore, about 3 miles west of Spanish Fork. A plain staff gage, graduated to feet and tenths, is driven into the bed of the stream near the west side and about 10 feet below the bridge. It is read twice each day by Frank Simmons. Discharge measurements are made by car and cable about 800 feet above the gage. On May 26, 1904, a gage was established at the cable. The gage heights for the entire year are referred to the original gage. The initial point for soundings is a 2 by 4 inch post driven into the right or south bank, marked "U. S. G. S. Initial point." The course of the section is north 6 west. At 35 feet a 2 by 4 inch post is driven into the north bank and marked "35 feet." The channel is straight for 100 feet above and 50 feet below the station. The current is swift. Both banks are high, composed of earth, and are not subject to overflow. At the left bank there is a lower bank of narrow width, which probably overflows during very high water. The bed of the stream is composed of clean gravel and sand, and is shifting. There is but one channel at all stages. An alternate measuring section was laid off nearly 350 feet upstream, where the bottom is much firmer, which may be used if the first section proves to be too unstable. Bench mark No. 1 bears south 18 3 ′ west, 10.5 feet from the gage, being a 30-penny nail driven into a log of the west abutment of the bridge near its northwest corner. Its elevation, 11.68 feet above the zero of the gage, is written in pencil. Bench mark No. 2 bears south 85° 30′ east 91 feet from the gage, being a 20-penny nail driven into the north side of a cedar fence post. Its elevation is 21.95 feet above the zero of the gage. Bench mark No. 3 bears south 21° 45′ east, 197 feet from the gage. It is a United States Geological Survey standard iron pipe bench mark, projecting about 15 inches above the ground. Its elevation above the zero of the gage, 21.76 feet, is stamped on the cap. A nail driven into the top of the initial point post of cross section No. 1 is 8.96 feet above the zero of the gage. The top of the initial post for the alternate cross section is 10.96 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Spanish Fork near Lake Shore, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
February 3	C. Tanner	25	2.39	3.02	60
February 24	do	44	2.56	3.65	112
March 27	W. P. Hardesty	33	2.69	3.35	88
April 22	C. Tanner	61	2.79	4.22	170
May 20	W. Swendsen	63	2.75	4.08	172
May 20	C. Tanner	65	2.73	4.08	177
May 26	W. Swendsen	33	2.51	3.40	82
December 22	do	22	2.27	[a] 4.61 2.80	50

[a] Gage at cable.

Mean daily gage height, in feet, of Spanish Fork near Lake Shore, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Dec.[a]
1	2.87	(b)	3.27	3.75	4.35	.....
2	2.90	3.00	3.36	3.72	4.37	.....
3	2.90	3.02	3.30	3.72	4.42	.....
4	2.92	2.97	3.35	4.00	4.85	.....
5	2.92	2.97	3.28	4.05	4.75	.....
6	2.92	2.90	3.23	3.90	4.72	.....
7	2.90	2.90	3.27	3.65	5.15	2.80
8	2.87	2.93	3.36	3.62	5.12	2.80
9	2.87	2.90	3.52	3.63	4.97	2.80
10	(b)	2.90	3.25	3.82	5.10	2.80
11	(b)	2.97	3.37	3.90	5.35	2.80
12	(b)	2.92	3.30	4.02	5.35	2.80
13	(b)	2.98	3.32	4.05	5.35	2.80
14	(b)	2.97	3.28	4.17	5.10	2.80
15	(b)	3.02	3.30	4.25	4.75	2.80
16	(b)	3.11	3.32	4.20	4.55	2.80
17	(b)	3.02	3.25	4.10	4.27	2.80
18	(b)	3.90	3.17	4.21	4.27	2.80
19	(b)	3.90	3.10	4.32	4.35	2.80
20	(b)	3.02	3.30	4.50	4.12	2.80
21	(b)	3.06	3.10	4.45	4.27	2.80
22	(b)	3.24	3.00	4.20	4.10	2.80
23	(b)	3.66	3.20	4.15	3.85	2.80
24	(b)	3.71	3.27	4.02	3.80	2.80
25	(b)	3.72	3.30	3.97	3.80	2.80
26	(b)	3.75	3.17	4.15	3.40	2.80
27	(b)	3.52	3.32	4.42	3.42	2.80
28	(b)	3.55	3.30	4.45	3.15	2.80
29	(b)	3.32	5.02	4.45	2.80	2.80
30	(b)	.....	4.17	4.32	2.55	2.80
31	(b)	.....	3.92	.....	2.37	2.80

[a] Gage heights are worked up by a comparison of gage heights at old and new gages and refer to old gage.
[b] Ice.

NOTE.—Total flow of river diverted for irrigation June 1 to December 6.

Rating table for Spanish Fork near Lake Shore, Utah, from January 1 to May 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.40	42	3.20	71	4.00	158	4.80	262
2.50	43	3.30	78	4.10	171	4.90	275
2.60	45	3.40	87	4.20	184	5.00	288
2.70	47	3.50	96	4.30	197	5.10	301
2.80	50	3.60	107	4.40	210	5.20	314
2.90	54	3.70	119	4.50	223	5.30	327
3.00	58	3.80	132	4.60	236	5.40	340
3.10	64	3.90	145	4.70	249	5.50	353

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is well defined between gage heights 3.00 feet and 4.10 feet. The table has been extended beyond these limits. Above gage height 3.70 feet the rating curve is a tangent, the difference being 13 per tenth.

Estimated monthly discharge of Spanish Fork near Lake Shore, Utah, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]	55	53	53.3	3,277
February	145	53	76.2	4,383
March	291	58	88.7	5,454
April	223	109	168	9,997
May	333	42	202	12,420
June [b]				
December 7–31 [c]				2,480
The period				38,010

[a] River frozen January 10 to February 1; discharge estimated.
[b] Stream dry June 1 to December 6.
[c] Water turned in river December 7; average discharge estimated at 50 second-feet.

GREAT SALT LAKE AT SALTAIR, UTAH.

A gage was established March 7, 1904, on Great Salt Lake, Utah, in connection with evaporation investigations being carried on at this place. The gage is located 500 feet northwest of the extreme northwest end of the temporary extension of the north wing of the bath houses of the Saltair pavilion. The gage is a staff, graduated to feet and tenths from −4 feet to +4.5 feet, attached to railroad irons driven vertically into the bed of the lake and securely braced. The lower end was

driven 1 foot into the lake bed, so that the −4 foot mark is about even with the sand. The zero of this gage is set 6 feet below the zero of the old Lake Shore gage (see Gilbert's Monograph on Lake Bonneville, pp. 231 and 409), and 2.33 feet below the zero of the temporary gage established at Saltair during 1903, by Dr. H. J. Hyatt, director of the United States Weather Bureau at Salt Lake City. Bench mark No. 1 is a United States Geological Survey standard bench-mark cap cemented on the top of the cap of a pile bent of the trestle support of the Salt Lake and Los Angeles Railroad. This is the thirteenth pile bent, 204 feet southeast of the end of the track. Its elevation is 11.17 feet above the zero of the gage, and 4,224.06 feet above sea level, as determined from Salt Lake City datum. Bench mark No. 2 is the head of a large screw driven into the northeast supporting post at the extreme northwest end of the row of bath houses, 500 feet southeast of the gage. Its elevation is 1.56 feet above the zero of the gage, and 4,214.45 feet sea level.

This station was turned over to the United States Weather Bureau.

Mean daily gage height, in feet, of Great Salt Lake at Saltair, Utah, for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1						17					1.20
2		0.8				18				1.50	1.20
3		.8				19	0.3				1.20
4		.8	1.30			20			1.40		1.20
5		.8	1.30	1.40		21			1.40		1.10
6					1.35	22		1.00	1.40		
7						23			1.40		
8		.8	1.30	1.50	1.35	24		1.00			
9		.8		1.50	1.35	25		1.25			
10				1.50		26				1.45	
11				1.50		27				1.40	
12	−0.2			1.50		28	.5		1.35	1.40	
13	.2	.8	1.35	1.50		29	.5		1.40		
14		.8	1.35	1.50		30		1.25			
15			1.35	1.50		31			1.40		
16	.3		1.35	1.50							

SEVIER RIVER NEAR GUNNISON, UTAH.

This station, established by Caleb Tanner on June 29, 1900, is at the wagon bridge which crosses the stream 4 miles west of the town of Gunnison on the road to West View precinct. The gage is a vertical 1 by 4 inch redwood timber painted white and nailed to a bridge pile near right bank of the stream. It is graduated by means of black paint to feet, tenths, and fiftieths. The gage is read once each day by I. H. Erickson. Discharge measurements are made at ordinary stages from the bridge to which the gage is attached. At low water they are made by wading about 200 feet below the bridge. The initial

point for soundings when measurements are made from the bridge is the bridge pile to which the gage is fastened, on the right bank of the stream. When measurements are made by wading the initial point for soundings is a 2 by 4 inch post driven into the right bank of the stream. On the left bank directly opposite the initial point is a 2 by 4 inch post, 93 feet from the initial point. The channel is straight for 300 feet above and below the station. Both banks are about 10 feet above the bed of the stream, covered with salt grass, and are not liable to overflow. The bed of the stream is composed of sand and gravel, free from vegetation, and is permanent. There is one channel at all stages. At low water the low velocity at the bridge makes the measurement inaccurate because of the bridge piles and floating débris. This is overcome by using the section below. Bench mark No. 1 is a large spike driven into the side of a cedar fence post S. 74° E. 46 feet from the gage. Its elevation is 8.55 feet above the zero of the gage. Bench mark No. 2 is a nail in top of railing post at the northeast corner of the bridge, 13 feet north of the gage. Its elevation is 13.18 feet above the zero of the gage. Bench mark No. 3 is S. 84° 30′ E. 153 feet from the gage, and is a United States Geological Survey standard iron bench mark. Its elevation is 10.10 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of Sevier River near Gunnison, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
January 13	C. Tanner	94	2.45	1.99	234
February 16	do	13	2.55	2.22	331
February 16	do	13	2.39	2.22	310
February 16	do	13	2.42	2.22	312
March 15	do	22	.97	.50	21
March 30	W. P. Hardesty	19	.74	.38	14
April 19	E. C. Murphy and C. Tanner.	24	1.04	.52	25
June 13	W. Swendsen	66	1.14	1.00	75
August 29	C. Tanner	31	1.26	.72	39
October 26	do	29	1.10	.68	32
December 4	W. Swendsen	68	1.17	1.00	80

Mean daily gage height, in feet, of Sevier River near Gunnison, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	2.40	1.00	0.44	0.48	0.78	0.64	0.56	0.68	0.56	0.68	0.96
2	.....	2.32	.94	.44	.....	.74	.66	.56	.68	.....	.68	.94
3	.....	2.34	.94	.50	.....	.70	.60	.56	.68	.....	.....	1.02
4	2.00	2.30	.84	.50	1.18	.70	.54	.56	.68	.56	.....	1.02
5	2.00	2.44	.82	.50	1.10	.....	.54	.56	.68	.48	.76	1.02
6	2.00	2.30	.82	.60	1.02	1.00	.56	.56	.68	.48	.76	1.02
7	1.90	2.00	.50	.60	.90	1.14	.74	.56	.64	.46	.78	1.00
8	1.76	2.30	.50	.54	.94	1.20	.76	.56	.64	.48	.78	1.00
9	(a)	2.30	.48	.54	1.12	1.10	.54	.56	.60	.48	.80	1.06
10	.....	2.38	.48	.....	1.04	1.08	.54	.56	.60	.46	.80	b 1.06
11	.....	2.10	.48	.....	1.24	1.20	.54	.56	.58	.48	.....	1.06
12	1.60	1.94	.46	.52	1.20	1.06	.....	.58	.58	.....	.....	1.06
13	2.02	2.24	.48	.54	1.26	.....	.56	.58	.58	.46	.76	1.06
14	2.00	2.00	.48	.56	1.24	1.00	.56	.58	.58	.48	.78	1.06
15	1.66	1.96	.48	.56	1.30	.90	.56	.58	.58	.48	.78	1.06
16	1.60	2.24	.50	.58	1.28	.84	.54	.58	.58	.48	.80	1.06
17	(a)	2.26	.48	.54	1.30	.84	.54	.58	.58	.48	.80	1.06
18	.....	2.22	.48	.52	1.34	.84	.50	.88	.58	.48	.....	1.06
19	.....	2.12	.48	.50	1.44	.80	.50	.80	.58	.48	.....	1.06
20	.....	2.00	.48	.52	1.28	.80	.50	.70	.58	.48	.....	1.06
21	.....	1.76	.48	.52	1.34	.72	.50	.70	.56	.60	.....	1.06
22	.....	1.70	.48	.52	.98	.72	.50	.66	.....	.60	.88	1.06
23	.....	2.00	.46	.50	.88	.70	.50	.68	.56	.60	.86	1.06
24	2.40	1.74	.48	.50	.94	.70	.46	.68	.56	.60	.86	1.06
25	2.32	1.50	.48	.40	.98	.72	.46	.68	.56	.60	.86	1.06
26	2.36	1.40	.48	.46	1.00	.74	.46	.68	.58	.68	.88	1.06
27	2.30	1.20	.28	.46	1.02	.74	.46	.68	.58	.....	.88	1.06
28	2.44	1.14	.28	.46	.90	.70	.50	.70	.58	.68	.94	1.06
29	2.30	1.00	.30	.46	.92	.72	.52	.74	.58	.68	.....	1.06
30	2.30	.....	.30	.48	.88	.....	.56	.74	.56	.....	.96	1.06
31	2.32	.....	.42	.....	.88	.....	.56	.74	.....	.....	.....	1.06

a Ice.
b December 9 reading assumed for rest of month on account of ice gorge. Highest reading of gorge 4.0 feet.

Rating table for Sevier River near Gunnison, Utah, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.20	8	0.80	49	1.40	152	2.00	269
.30	11	.90	62	1.50	172	2.10	289
.40	16	1.00	77	1.60	191	2.20	308
.50	22	1.10	94	1.70	211	2.30	328
.60	29	1.20	113	1.80	230	2.40	347
.70	38	1.30	133	1.90	250	2.50	367

The above table is applicable only for open-channel conditions. It is based upon 10 discharge measurements made during 1904. It is well defined between gage heights 0.40 foot and 2.20 feet. The table has been extended beyond these limits. Above gage height 1.10 feet the rating curve is a tangent, the difference being 19.5 per tenth.

Estimated monthly discharge of Sevier River near Gunnison, Utah, for 1904.

[Drainage area, 3,986 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	355	191	255	15,680	0.064	0.074
February	355	77	267	15,360	.067	.072
March	77	10	27.4	1,685	.0069	.0080
April	29	16	22.9	1,363	.0057	.0064
May	160	21	92.9	5,712	.023	.027
June	113	36	59.0	3,511	.015	.017
July	45	20	25.7	1,580	.0064	.0074
August	59	26	32.8	2,017	.0082	.0095
September	36	26	29.6	1,761	.0074	.0083
October	36	20	25.7	1,580	.0064	.0074
November	71	36	51.4	3,058	.013	.014
December [a]	.....	.....	84.3	5,183	.021	.024
The year	.....	.....	81.1	58,490	.020	.275

[a] Ice gorge December 10–31; discharge estimated.

NOTE.—Discharge estimated for missing gage heights.

SAN PITCH RIVER NEAR GUNNISON, UTAH.

This station was established June 30, 1900, by Caleb Tanner. It is located 4 miles northeast of Gunnison and one-eighth mile west of the Rio Grande and Western Railroad. The station is just west of the second farmhouse along the railroad track north from Gunnison. The gage consists of a vertical timber driven firmly into the bed of the stream and strongly braced, near the left bank of the stream, about 100 feet above the ford. It is painted white and graduated to feet, tenths, and fiftieths. The gage is read once each day by Oliver Pederson. Discharge measurements are made by wading directly under a wire stretched across the river at the station. The initial point for soundings is the west side of a post about 3 feet high, on the left bank, to which the tagged line is attached. The channel is straight for 100 feet above and slightly curved below the station. The current is swift. Both banks are about 5 feet above the bed of the stream, composed of clay, and covered with grass. The bed of the stream is composed of sand and gravel. It is clean and fairly permanent. There is but one channel at all stages. The bed shifts somewhat during floods, but other than this, the conditions are good for accuracy. Bench mark No. 1 is the top of a cedar post, 1 foot in diameter, set firmly in the ground 45.5 feet west of the gage rod. Its elevation is 5.96 feet above the gage datum. Bench mark No. 2 is the top of a nail driven into the top of a stake driven into the ground at the foot of a fence post on the west side of a stockyard S. 84° E. 150 feet from the initial point for soundings. Its elevation is 10.36 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of G. L. Swendsen, district engineer.

Discharge measurements of San Pitch River near Gunnison, Utah, in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
February 15	C. Tanner	21	0.83	1.82	18
March 16	do	19	.64	1.75	12
March 31	W. P. Hardesty	18	.54	1.68	10
April 19	E. C. Murphy and C. Tanner.	27	2.22	2.13	60
June 14	W. Swendsen	41	[a] 1.79	2.25	75
June 14	do	41	[b] 1.79	2.25	73
June 14	do	41	[c] 1.70	2.25	70
September 1	C. Tanner	22	.94	1.87	21
December 5	W. Swendsen	17	.42	1.62	7

[a] Six-tenth method. [b] Integration method. [c] Top and bottom method.

Mean daily gage height, in feet, of San Pitch River near Gunnison, Utah, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.78	1.80	1.74	1.70	2.26	2.42	2.32	2.34	1.88	1.84	1.86	1.70
2	1.76	1.80	1.72	1.68	2.24	2.40	2.32	2.34	1.86	1.84	1.86	1.70
3	1.78	1.80	1.70	1.68	2.32	2.34	2.32	2.30	1.86	1.84	1.84	1.70
4	1.78	1.80	1.70	1.68	2.30	2.32	2.30	2.30	1.86	1.82	1.86	1.70
5	1.80	1.80	1.70	1.68	2.36	2.30	2.38	2.30	1.84	1.82	1.84	1.70
6	1.80	1.78	1.72	1.68	2.30	2.28	2.46	2.30	1.84	1.80	1.82	1.62
7	1.78	1.78	1.72	1.62	2.38	2.26	2.46	2.30	1.84	1.82	1.82	1.62
8	1.78	1.80	1.72	1.62	2.30	2.32	2.44	2.28	1.84	1.82	1.82	1.70
9	1.70	1.78	1.70	1.64	2.24	2.32	2.46	2.26	1.84	1.84	1.82	1.74
10	1.78	1.76	1.70	1.64	2.24	2.30	2.44	2.24	1.82	1.82	1.91	1.64
11	1.78	1.78	1.70	1.64	2.40	2.24	2.44	2.24	1.82	1.80	1.79	1.74
12	1.80	1.78	1.70	1.68	2.70	2.28	2.44	2.22	1.82	1.82	1.79	1.72
13	1.78	1.78	1.70	1.80	2.56	2.26	2.44	2.20	1.82	1.84	1.80	1.71
14	1.80	1.78	1.70	1.82	2.96	2.26	2.46	2.14	1.82	1.82	1.83	1.71
15	1.78	1.82	1.74	1.88	2.52	2.26	2.48	2.14	1.82	1.84	1.78	1.62
16	1.70	1.78	1.74	1.88	2.96	2.26	2.46	2.13	1.82	1.84	1.78	1.60
17	1.78	1.78	1.74	1.90	2.82	2.26	2.44	1.90	1.82	1.84	1.78	1.73
18	1.78	1.80	1.74	1.90	3.10	2.26	2.42	1.90	1.82	1.84	1.80	1.72
19	1.78	1.82	1.74	2.14	2.74	2.24	2.40	1.88	1.80	1.84	1.80	1.64
20	1.78	1.72	1.70	2.18	2.58	2.20	2.42	1.88	1.80	1.84	1.74	1.73
21	1.80	1.78	1.74	2.14	2.42	2.20	2.42	1.88	1.80	1.84	1.73	1.73
22	1.78	1.80	1.68	2.10	2.44	2.26	2.42	1.86	1.80	1.86	1.72	1.73
23	1.72	1.80	1.70	2.10	2.82	2.26	2.40	1.84	1.80	1.86	1.73	1.73
24	1.78	1.80	1.70	2.10	3.10	2.26	2.40	1.84	1.80	1.86	1.60	1.74
25	1.80	1.78	1.70	2.16	2.90	2.24	2.40	1.84	1.80	1.86	1.60	1.80
26	1.80	1.76	1.70	2.16	2.90	2.24	2.40	1.88	1.82	1.86	1.60	1.60
27	1.80	1.76	1.70	2.24	2.68	2.28	2.34	1.86	1.82	1.86	1.60	1.61
28	1.76	1.76	1.70	2.24	2.64	2.26	2.34	1.86	1.84	1.86	1.64	1.61
29	1.80	1.76	1.80	2.24	2.58	2.30	2.40	1.86	1.84	1.86	1.64	1.64
30	1.78	.....	1.70	2.22	2.54	2.32	2.36	1.88	1.86	1.86	1.64	1.70
31	1.80	.....	1.68	.....	2.36	.....	2.36	1.88	.....	1.86	.....	1.72

Rating table for San Pitch River near Gunnison, Utah, from January 1 to December 31, 1904.

Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	6	2.00	33	2.40	110	2.80	198
1.70	10	2.10	47	2.50	132	2.90	220
1.80	16	2.20	66	2.60	154	3.00	242
1.90	23	2.30	88	2.70	176		

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904. It is well defined between gage heights 1.60 feet and 2.30 feet. The table has been extended beyond these limits. Above gage height 2.20 feet the rating curve is a tangent, the difference being 22 per tenth.

Estimated monthly discharge of San Pitch River near Gunnison, Utah, for 1904.

[Drainage area, 836 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	16	10	14.8	910	0.018	0.021
February	17	14	15.2	874	.018	.019
March	12	9	10.7	658	.013	.015
April	75	7	31.6	1,880	.038	.042
May	264	75	147	9,039	.176	.203
June	114	66	83.5	4,969	.100	.112
July	128	88	111	6,825	.133	.153
August	97	19	50.4	3,099	.060	.069
September	22	16	17.8	1,059	.021	.023
October	20	16	18.7	1,150	.022	.025
November	24	6	14.2	845	.017	.019
December	16	6	9.9	609	.012	.014
The year	264	6	43.7	31,920	.052	.715

HUMBOLDT RIVER (NORTH FORK) NEAR ELBURZ, NEV.

This station was established October 10, 1902, by E. C. Murphy. It is located 150 feet below the Southern Pacific Railroad bridge and about one-fourth mile above the junction of the North Fork with Humboldt River. It is 2 miles west of the Southern Pacific Railroad station at Elburz. The nearest post-office is Halleck, Nev. The gage is an inclined 4 by 4 inch timber fastened to the left bank just above the cable. It is read once each day by A. R. Blevins. Discharge measurements are made by means of a cable and car. The initial point for soundings is the zero on the tagged wire. The channel is straight for 150 feet above and below the station. There is but one channel at all stages, and the current is sluggish. Both banks are high. The left bank will overflow at extreme flood stages. The bed of the stream is composed of gravel and silt, and changes slightly. The bench mark is a 4 by 4 inch timber driven in the ground on the left bank about 20 feet upstream from the gage. Its elevation is 6.99 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Humboldt River (North Fork) near Elburz, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 21	W. A. Wolf	40	87	2.28	4.15	198
April 11	do	40	89	2.11	4.10	188
May 3	do	40	95	1.90	4.06	180
May 17	do	40	88	1.84	4.00	162
June 7 [a]	do	40	104	1.54	4.75	160
June 17	do	41	82	1.18	4.65	97
June 28	do	38	23	1.52	3.55	35
July 9	do	38	20	1.28	3.40	26
July 18	do	15	17	1.39	3.35	24
August 18	do	9	6.5	1.04	3.10	6.8

[a] Backwater.

Mean daily gage height, in feet, of Humboldt River (North Fork) near Elburz, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov	Dec.
1	1.80	2.00	4.10	4.60	4.00	5.20	3.50	3.20	3.00	3.10	3.30	3.20
2	1.90	2.00	4.30	4.50	4.10	5.10	3.40	3.15	3.00	3.10	3.30	3.20
3	1.90	2.00	4.40	4.40	4.10	.....	3.40	3.15	3.00	3.10	3.30	3.20
4	1.90	2.00	4.30	4.30	4.00	5.10	3.40	3.15	3.00	3.10	3.30	3.20
5	1.90	2.00	4.20	4.20	3.90	5.00	3.40	3.15	3.00	3.15	3.30	3.30
6	1.90	2.00	4.00	4.20	3.80	.....	3.40	3.10	3.00	3.15	3.30	3.40
7	1.90	2.10	3.80	4.10	3.70	4.80	3.40	3.10	3.00	3.15	3.30	3.40
8	1.90	2.10	3.80	4.10	3.60	4.90	3.40	3.10	3.00	3.15	3.30	3.40
9	1.90	2.10	4.00	4.10	3.50	5.00	3.40	3.10	3.00	3.15	3.30	3.30
10	1.90	2.10	4.10	4.00	3.60	4.90	3.40	3.10	3.00	3.20	3.30	3.30
11	1.90	2.20	4.10	4.00	3.70	4.80	3.30	3.10	3.00	3.20	3.30	3.30
12	1.90	2.20	4.00	4.10	3.80	4.80	3.30	3.10	3.00	3.20	3.30	3.40
13	1.90	2.30	3.90	4.10	4.00	4.80	3.40	3.10	3.00	3.25	3.30	3.40
14	1.90	2.70	3.90	4.20	4.10	4.70	3.40	3.10	3.00	3.25	3.25	3.40
15	1.90	2.70	4.00	4.30	4.10	4.70	3.40	3.10	3.00	3.30	3.25	3.40
16	1.90	2.70	4.00	4.40	4.00	4.60	3.35	3.10	3.00	3.30	3.20	3.30
17	1.80	2.30	3.90	4.40	4.10	4.50	3.35	3.10	3.00	3.30	3.20	3.30
18	1.80	2.40	4.00	4.50	4.10	4.40	3.35	3.10	3.00	3.30	3.20	3.30
19	1.80	2.40	4.00	4.50	4.20	4.40	3.35	3.10	3.00	3.30	3.20	3.30
20	1.80	2.40	4.00	4.40	4.30	4.30	3.35	3.10	3.00	3.30	3.20	3.30
21	1.80	2.80	4.00	4.30	4.40	4.10	3.35	3.05	3.00	3.30	3.20	3.35
22	1.80	2.70	4.10	4.20	5.40	4.00	3.35	3.05	3.00	3.30	3.20	3.40
23	1.80	2.80	4.00	4.10	5.10	3.90	3.30	3.00	3.00	3.30	3.20	3.40
24	1.90	.....	4.10	4.40	5.00	3.80	3.30	3.00	3.00	3.30	3.15	3.40
25	1.90	6.00	4.20	4.30	4.90	3.70	3.30	3.00	3.05	3.30	3.10	3.45
26	1.90	5.40	4.10	4.20	5.50	3.50	3.30	3.00	3.10	3.30	3.10	3.45
27	1.90	5.00	4.00	4.20	5.60	3.40	3.30	3.00	3.10	3.30	3.20	3.50
28	1.90	4.20	4.00	4.10	5.60	3.40	3.20	3.00	3.10	3.30	3.20	3.55
29	2.00	4.00	4.10	4.00	5.50	3.40	3.20	3.00	3.10	3.30	3.20	3.60
30	2.00	.....	4.20	3.90	.....	3.50	3.20	3.00	3.10	3.30	3.15	3.60
31	2.00	.....	4.40	.....	5.30	.....	3.20	3.00	.....	3.30	.....	3.60

NOTE.—River frozen January 1 to February 23 (practically no flow).

Rating table for Humboldt River (North Fork) near Elburz, Nev., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.00	5	3.80	105	4.60	328	5.40	552
3.10	7	3.90	132	4.70	356	5.50	580
3.20	11	4.00	160	4.80	384	5.60	608
3.30	18	4.10	188	4.90	412	5.70	636
3.40	27	4.20	216	5.00	440	5.80	664
3.50	40	4.30	244	5.10	468	5.90	692
3.60	59	4.40	272	5.20	496	6.00	720
3.70	81	4.50	300	5.30	524		

NOTE.—From February 24 to 28 and from May 22 to June 22, 1904, take 50 per cent of the discharge given in the table, on account of backwater.

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is well defined between gage heights 3.10 feet and 4.15 feet. The table has been extended beyond these limits. Above gage height 3.85 feet the rating curve is a tangent, the difference being 28 per tenth.

Estimated monthly discharge of Humboldt River (North Fork) near Elburz, Nev., for 1904.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
February 25–29	720	160	418	4,046	0.410	0.076
March	412	105	184	11,310	.180	.208
April	328	132	226	13,450	.222	.248
May	608	40	274	16,850	.269	.310
June	496	27	284	16,900	.278	.310
July	40	11	22.2	1,365	.022	.025
August	11	5	6.7	412	.0066	.0076
September	7	5	5.4	321	.0053	.0059
October	18	7	14.0	861	.014	.016
November	18	7	13.8	821	.014	.016
December	59	11	26.8	1,648	.026	.030
The period				67,980		

HUMBOLDT RIVER AT PALISADE, NEV.

This station was established November 27, 1902, by E. C. Murphy. The gage is a vertical 1 by 4 inch board spiked to the right abutment of the single-span highway bridge one-fourth mile from the hotel at Palisade. It is read once each day by T. H. Jewell, the hotel keeper. There is a railroad bridge about 500 feet below. Discharge measurements are made by means of a cable and car one-fourth mile above the gage. At very low stages, when the current becomes sluggish at the cable, measurements are made by wading a short distance above. The initial point for soundings is the zero on the tagged wire. The channel is straight for 200 feet above and for 300 feet below the station. The right bank is low and liable to overflow. The left bank is high. The bed of the stream is composed of gravel and sand and is permanent. There is but one channel at all stages. The bench mark consists of a spike and three nails driven into the bridge abutment to which the gage is fastened. Its elevation is 7.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Humboldt River at Palisade, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 23	W. A. Wolf	104	350	2.13	3.81	745
April 13	do	105	410	2.35	4.30	964
May 4	do	103	460	2.53	4.65	1,165
May 16	do	106	460	2.50	4.62	1,152
June 6	do	110	578	2.92	5.80	1,685
June 16	do	110	556	2.90	5.60	1,614
June 27	do	106	466	2.45	4.58	1,144
July 8	do	104	313	1.91	3.45	597
July 18	do	103	282	1.88	3.10	531
July 27	do	97	209	1.43	2.40	298
August 17	do	40	43	1.75	1.40	75
September 5	do	30	36	1.56	1.30	56

Mean daily gage height, in feet, of Humboldt River at Palisade, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.60	1.50	4.90	4.30	4.70	6.00	4.10	1.95	1.30	1.40	1.90	1.95
2	1.60	1.50	5.40	4.30	4.70	6.00	3.95	1.90	1.30	1.50	1.90	1.95
3	1.60	1.50	4.90	4.50	4.70	6.00	3.70	1.90	1.30	1.60	1.90	1.95
4	1.60	1.50	4.50	4.60	4.70	5.90	3.60	1.80	1.30	1.60	1.90	1.95
5	1.60	1.50	4.20	4.50	4.70	5.90	3.55	1.70	1.30	1.60	1.90	1.95
6	1.60	1.50	4.60	4.40	5.00	5.90	3.50	1.70	1.40	1.60	1.90	1.95
7	1.50	1.50	4.60	4.40	4.70	5.80	3.45	1.70	1.40	1.60	1.90	1.95
8	1.50	1.50	4.70	4.40	4.70	5.80	3.45	1.65	1.40	1.60	1.90	1.95
9	1.50	1.55	4.50	4.20	4.60	5.80	3.45	1.60	1.40	1.60	1.90	1.95
10	1.50	1.60	3.80	4.20	4.50	5.70	3.45	1.60	1.40	1.60	1.90	1.95
11	1.50	1.65	3.80	4.20	4.50	5.70	3.40	1.60	1.40	1.75	1.90	1.95
12	1.55	1.65	3.70	4.40	4.40	5.70	3.35	1.55	1.40	1.75	1.90	1.95
13	1.55	1.70	3.90	4.50	4.50	5.60	3.30	1.50	1.40	1.80	1.95	1.90
14	1.60	1.70	3.90	4.40	4.50	5.50	3.20	1.40	1.40	1.80	1.95	1.80
15	1.60	1.70	3.90	4.50	4.50	5.50	3.20	1.40	1.40	1.80	1.95	1.75
16	1.60	2.00	3.70	4.60	4.60	5.50	3.20	1.40	1.40	1.90	1.95	1.75
17	1.60	3.00	3.70	4.70	4.60	5.40	3.15	1.40	1.40	1.90	1.95	1.75
18	1.60	1.50	3.80	4.70	4.70	5.40	3.10	1.40	1.40	1.90	1.95	1.70
19	1.60	2.00	3.90	4.70	4.70	5.40	3.00	1.40	1.40	1.90	1.95	1.70
20	1.50	2.00	3.90	4.90	4.90	5.20	3.00	1.40	1.30	1.90	1.95	1.70
21	1.50	2.20	3.80	5.00	5.00	5.20	2.90	1.40	1.30	1.90	1.95	1.70
22	1.50	5.00	3.80	5.00	5.20	5.20	2.80	1.40	1.30	1.90	1.95	1.70
23	1.50	6.00	3.80	4.90	5.30	5.10	2.70	1.40	1.30	1.90	1.95	1.70
24	1.50	4.50	3.80	4.90	5.40	5.00	2.60	1.40	1.30	1.90	1.95	1.70
25	1.50	4.60	3.80	4.90	5.80	4.90	2.60	1.40	1.40	1.90	1.95	1.70
26	1.50	4.90	3.80	4.90	6.00	4.80	2.50	1.40	1.40	1.90	1.95	1.70
27	1.50	4.95	3.80	4.90	6.00	4.60	2.40	1.40	1.40	1.90	1.95	1.70
28	1.50	5.20	3.80	4.70	6.00	4.50	2.35	1.40	1.40	1.90	1.95	1.70
29	1.50	4.70	3.80	4.50	6.00	4.40	2.20	1.40	1.40	1.90	1.95	1.75
30	1.50	.....	4.50	4.60	6.00	4.30	2.00	1.40	1.40	1.90	1.95	1.80
31	1.50	.....	4.30	.....	6.00	.....	2.00	1.40	.....	1.90	.....	1.80

Rating table for Humboldt River at Palisade, Nev., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	57	2.40	279	3.50	643	4.60	1,135
1.40	70	2.50	307	3.60	682	4.70	1,185
1.50	85	2.60	336	3.70	722	4.80	1,235
1.60	101	2.70	366	3.80	764	4.90	1,285
1.70	119	2.80	397	3.90	806	5.00	1,335
1.80	139	2.90	429	4.00	850	5.10	1,385
1.90	159	3.00	462	4.10	895	5.20	1,435
2.00	180	3.10	496	4.20	941	5.40	1,535
2.10	202	3.20	531	4.30	988	5.60	1,635
2.20	226	3.30	567	4.40	1,036	5.80	1,735
2.30	252	3.40	605	4.50	1,085	6.00	1,835

The above table is applicable only for open-channel conditions. It is based upon 15 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.30 feet and 5.80 feet. Above gage height 4.50 feet the rating curve is a tangent, the difference being 50 per tenth.

Estimated monthly discharge of Humboldt River at Palisade, Nev., for 1904.

[Drainage area, 5,014 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	101	85	91.7	5,638	0.018	0.021
February	1,835	85	461	26,520	.092	.099
March	1,535	722	910	55,950	.181	.209
April	1,335	941	1,128	67,120	.225	.251
May	1,835	1,036	1,345	82,700	.268	.309
June	1,835	988	1,532	91,160	.306	.341
July	895	180	500	30,740	.100	.115
August	169	70	91.4	5,620	.018	.021
September	70	57	65.7	3,909	.013	.014
October	159	70	135	8,301	.027	.031
November	169	159	165	9,818	.033	.037
December	169	119	143	8,793	.029	.033
The year	1,835	57	547	396,300	.109	1.48

HUMBOLDT RIVER NEAR GOLCONDA, NEV.

The gaging station at Golconda is located near the great northern bend of Humboldt River and below the central valley. It is about 12 miles above the mouth of Little Humboldt River. The station was established by L. H. Taylor October 24, 1894, and has been maintained continuously since that time. It is located 1¼ miles north of the town. An inclined gage, installed November 28, 1902, by E. C. Murphy, was fastened to the left bank by 4 by 4 inch stakes. The zeros of this and the original gage were at the same elevation. The bench mark was a 4 by 4 inch timber driven 4 feet north of the cable post on the left bank, at an elevation of 10.75 feet above the zero of the gage. Measurements prior to 1904 were made from a cable and car. During 1904 the discharge measurements were made from the upper side of a wagon bridge, constructed during the winter of 1903–4, 10 feet above the cable. A new gage rod and bench mark were established October 4, 1904. The new gage is a 4 by 4 inch timber driven vertically into the river bed, and its upper end is securely fastened to a stringer on the downstream side of the north or right end of the wagon bridge. The new bench mark is the head of the lowest rivet of the strut at the northwest corner of the bridge. The elevation of the new bench mark is 13.42 feet above the zero of the new gage. The

new bench mark is 0.48 foot lower than the old bench mark, so that the new gage zero is 3.15 feet below the old zero. The banks are moderately high, but liable to overflow at extreme high water. The bed of the stream is of gravel and sand and is somewhat shifting.

The channel is straight for 300 feet above and for 100 feet below the station. There is but one channel at all stages. At the cable the current is sluggish at low stages, but measurements can be made above or below by wading. The gage is read once each day by Walter Lyng.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Humboldt River near Golconda, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 24	W. A. Wolf	80	344	1.93	5.43	663
April 14	do	81	429	2.02	6.30	861
May 5	do	81	443	2.06	6.60	913
May 15	do	80	381	1.93	5.72	737
June 5	do	81	412	2.01	6.20	830
June 15	do	83	478	2.20	6.75	1,050
June 26	do	83	444	2.09	6.35	930
July 7	do	82	376	2.00	5.80	752
July 19	do	75	227	1.73	4.10	394
July 28	do	67	185	1.43	3.50	265
August 20	do	43	46	1.59	1.35	70
September 3	do	41	25	1.39	.95	35
October 1	do	24	25	1.30	1.00	34

Mean daily gage height, in feet, of Humboldt River near Golconda, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	−0.80	−0.70	4.40	6.00	6.60	a 5.80	6.00	a 3.25	a 1.10	0.80	a 1.85	2.45
2	− .80	− .60	4.80	6.00	a 6.70	a 5.90	6.20	a 3.10	1.00	a .80	1.85	2.45
3	− .80	− .40	5.00	6.10	6.80	6.00	a 6.20	3.00	.90	a .85	a 1.80	2.45
4	− .80	− .20	5.10	6.20	a 6.70	6.00	a 6.10	3.00	a .80	a .85	1.75	2.95
5	− .70	.00	5.20	6.30	6.60	a 6.15	a 6.10	2.90	a .70	.85	1.75	a 3.05
6	− .70	.20	5.20	6.30	a 6.50	a 6.30	6.00	2.90	a .60	.85	a 1.85	a 3.10
7	− .80	.30	5.30	6.40	6.40	6.50	a 6.00	a 2.90	.60	.95	a 1.95	3.15
8	− .90	.40	5.40	6.50	a 6.30	a 6.65	6.00	a 2.80	.40	1.65	a 2.00	a 3.20
9	− .90	.50	5.30	6.80	a 6.25	a 6.80	5.80	a 2.80	.40	a 1.55	2.05	3.25
10	− .90	.50	5.20	a 6.80	6.20	6.80	a 5.70	2.80	.30	a 1.45	2.05	3.25
11	− .90	.60	5.10	a 6.80	a 6.10	6.80	a 5.65	2.70	.30	a 1.40	2.15	3.15
12	− .90	.70	5.00	6.80	6.00	a 6.80	5.60	2.70	a .30	1.35	2.25	a 3.00
13	− .90	.70	5.10	a 6.55	5.60	a 6.80	5.40	2.60	a .30	1.85	2.25	a 2.90
14	− .90	.80	5.20	6.30	a 5.60	a 6.70	a 5.30	a 2.40	a .30	1.85	a 2.25	2.75
15	− .90	1.00	5.20	a 6.65	a 5.60	6.70	5.25	a 2.20	.30	1.75	a 2.25	2.35
16	− .90	1.00	5.20	7.00	5.60	6.70	5.20	2.00	.20	1.75	2.25	2.25
17	− .90	1.20	5.30	a 6.65	a 5.50	6.60	5.20	a 1.75	.10	a 1.65	a 2.35	a 2.15
18	− .90	1.20	5.30	6.30	a 5.35	6.60	a 5.00	a 1.50	.10	a 1.60	2.45	2.05
19	− .90	1.30	5.30	a 6.15	5.20	a 6.50	a 4.75	1.30	a .10	1.55	2.45	a 2.15
20	− .90	1.30	5.30	6.00	5.10	a 6.50	a 4.50	1.10	a .10	1.55	2.45	a 2.20
21	− .90	1.50	5.30	a 6.00	5.10	6.40	4.30	a 1.10	a .10	1.55	a 2.45	2.25
22	− .90	1.70	5.30	6.00	a 5.00	6.10	3.80	a .90	.10	a 1.60	a 2.45	2.25
23	− .90	1.80	5.40	6.10	4.90	a 6.35	3.80	a .80	.00	1.65	2.45	a 2.20
24	− .90	2.00	5.40	6.10	a 5.15	6.30	a 3.75	.80	.00	a 1.70	2.45	a 2.15
25	− .90	2.40	5.50	a 6.15	5.40	6.30	3.70	.60	a .20	a 1.70	2.55	2.15
26	− .90	2.60	5.50	6.20	a 5.40	a 6.35	3.70	.70	.40	1.75	a 2.45	a 2.05
27	− .90	3.00	5.60	a 6.30	5.40	6.20	3.70	.80	a .55	a 1.80	2.35	a 1.95
28	− .90	3.60	5.70	a 6.35	5.20	6.20	a 3.60	a 1.15	a .70	1.85	a 2.35	1.85
29	− .80	3.80	5.80	6.40	5.20	a 6.10	a 3.60	1.50	.80	1.85	a 2.35	2.35
30	− .80	.....	6.00	6.50	5.50	a 6.10	3.50	1.30	.80	a 1.85	2.35	a 2.60
31	− .80	.....	6.00	.....	a 5.65	.....	a 3.40	a 1.20	.....	a 1.85	.....	2.85

a Interpolated

NOTE.—Gage heights for entire year refer to old gage. River frozen January 1 to February 4.

Rating table for Humboldt River near Golconda, Nev., from February 5 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.00	4	1.50	75	3.00	221	4.50	450
0.10	6	1.60	83	3.10	233	4.60	470
0.20	8	1.70	91	3.20	245	4.70	490
0.30	10	1.80	99	3.30	258	4.80	511
0.40	13	1.90	108	3.40	271	5.00	554
0.50	16	2.00	117	3.50	285	5.20	599
0.60	20	2.10	126	3.60	299	5.40	646
0.70	24	2.20	136	3.70	314	5.60	694
0.80	29	2.30	146	3.80	329	5.80	743
0.90	35	2.40	156	3.90	344	6.00	793
1.00	41	2.50	166	4.00	360	6.20	845
1.10	47	2.60	177	4.10	377	6.40	898
1.20	54	2.70	188	4.20	394	6.60	952
1.30	61	2.80	199	4.30	412	6.80	1,007
1.40	68	2.90	210	4.40	431	7.00	1,063

The above table is applicable only for open-channel conditions. It is based upon 13 discharge measurements made during 1904 and 2 measurements of 1903. It is not very well defined, owing to the shifting character of the bed.

Estimated monthly discharge of Humboldt River near Golconda, Nev., for 1904.

[Drainage area, 10,780 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
February 5–29	329	4	81.6	4,047	0.0076	0.0071
March	793	431	625	38,430	.058	.067
April	1,063	793	887	52,780	.082	.091
May	1,007	532	739	45,440	.069	.080
June	1,007	743	902	53,670	.084	.094
July	845	271	562	34,560	.052	.060
August	252	20	124	7,624	.012	.014
September	47	4	15.8	940	.0015	.0017
October	104	29	76.2	4,685	.0071	.0082
November	172	95	138	8,212	.013	.014
December	252	104	173	10,640	.016	.018
The period				261,000		

NOTE.—From April to December, inclusive, several days in each month are interpolated. River frozen January 1 to February 4, with only a slight flow.

HUMBOLDT RIVER NEAR OREANA, NEV.

On the lower reaches of this river measurements have been made for a number of years near Oreana, and the results show the amount of water available for storage at the possible reservoir sites in the vicinity of Humboldt station and also for the six canal systems now in operation below Oreana. The station established by L. H. Taylor, January 27, 1896, was located at the old Oreana highway bridge, about 12 miles northeast of Lovelocks, Nev. The bridge abutment to which the gage was fastened was undermined and fell May 26, 1897. A temporary gage was used until September 8, 1897, when a new inclined one was placed on the left bank of the river about a mile and a half above the site of the old gage and opposite the Central Pacific Railroad section house.

This gage was washed out. The present gage was established November 29, 1902, by E. C. Murphy. It is vertical, in two sections, and is spiked to piles at the site of the old dam. The datum is the same as that of the old gage. The gage is read once each day by W. M. Maughmer. Discharge measurements are made at high water by means of a cable and car located at the gage. At low water measurements are made by wading a short distance below the station. The channel is straight for 300 feet above and for 200 feet below the station. The current is moderate. The right bank is high and will not overflow. The left bank will overflow only at extreme high water. There is but one channel at all stages. The bed of the stream is sandy and shifting. The bench mark consists of 4 nails driven into the pile to which the upper section of the gage is fastened. Its elevation is 5.00 feet above the zero of the gage. On October 1, 1904, the gage rod was lowered 2 feet. The elevation of the bench mark is now 7.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Humboldt River near Oreana, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 25	W. A. Wolf	109	241	2.07	2.48	498
April 9	do	110	292	2.24	3.01	653
May 6	do	110	335	2.35	3.46	788
May 14	do	110	295	2.25	2.97	664
June 4	do	110	273	2.15	2.85	587
June 15	do	110	338	2.24	3.41	757
June 25	do	106	287	2.29	3.15	656
July 6	do	110	337	2.24	3.40	756
July 17	do	110	280	2.18	2.90	610
August 16	do	101	78	1.60	.88	125
September 2	do	77	36	1.19	.40	43
September 30	do	22	18	.97	.20	17

Mean daily gage height, in feet, of Humboldt River near Oreana, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.10	0.20	0.60	2.80	3.90	2.50	3.42	1.75	0.40	0.20	0.60	0.80
2	.10	.30	.60	2.80	4.00	2.60	3.40	1.70	.40	.20	.60	.80
3	.10	.50	.70	2.90	4.00	2.70	3.40	1.60	.35	.20	.60	.80
4	.20	.60	.80	2.90	3.90	2.90	3.40	1.55	.30	.20	.60	1.00
5	.20	.60	.80	2.90	3.70	2.82	3.40	1.50	.30	.20	.60	1.10
6	.20	.80	1.00	3.00	3.50	2.80	3.38	1.40	.30	.20	.60	1.10
7	.20	.80	1.30	3.00	3.40	2.88	3.35	1.35	.30	.25	.60	1.10
8	.20	.80	1.60	3.10	3.30	2.88	3.32	1.30	.30	.20	.60	1.10
9	.20	.90	1.70	3.10	3.30	2.88	3.30	1.25	.30	.80	.60	1.10
10	.20	1.00	1.90	3.10	3.10	2.85	3.20	1.20	.30	.80	.60	1.10
11	.20	1.00	1.90	3.10	3.10	2.85	3.15	1.15	.30	.60	.60	1.15
12	.20	1.10	1.90	3.20	3.00	2.90	3.10	1.10	.25	1.20	.65	1.20
13	.20	1.30	2.00	3.20	2.80	3.00	3.00	1.05	.25	.90	.65	1.25
14	.20	1.20	2.00	3.20	2.80	3.00	2.90	1.00	.20	.50	.65	1.30
15	.20	1.00	2.10	3.20	2.80	3.10	2.85	.95	.15	.40	.65	1.40
16	.20	.80	2.20	3.20	2.80	3.30	2.80	.90	.10	.40	.70	1.45
17	.20	.60	2.20	3.10	2.70	3.40	2.75	.85	.10	.50	.70	1.50
18	.20	.50	2.20	3.10	2.70	3.55	2.70	.85	.10	.50	.70	1.50
19	.20	.30	2.30	3.10	2.70	3.50	2.65	.80	.05	.50	.70	1.40
20	.20	.20	2.30	3.10	2.70	3.40	2.60	.75	.05	.55	.75	1.20
21	.20	.30	2.40	3.10	2.70	3.30	2.55	.70	.05	.55	.75	1.10
22	.20	.30	2.40	3.00	2.70	3.20	2.50	.65	.10	.60	.75	1.00
23	.20	.20	2.50	3.00	2.68	3.15	2.40	.60	.10	.60	.75	1.00
24	.20	.20	2.50	3.00	2.65	3.05	2.30	.55	.25	.60	.75	.90
25	.20	.20	2.60	2.90	2.65	3.00	2.20	.60	.30	.60	.80	1.00
26	.20	.20	2.60	2.90	2.60	3.10	2.10	.60	.40	.60	.80	1.10
27	.20	.20	2.60	3.10	2.40	3.15	2.05	.60	.30	.60	.80	1.20
28	.20	.30	2.60	3.40	2.10	3.20	2.00	.55	.25	.60	.80	1.30
29	.20	.50	2.60	3.60	2.05	3.30	1.95	.50	.25	.60	.80	1.25
30	.20	.....	2.70	3.80	2.15	3.45	1.90	.45	.25	.60	.80	1.20
31	.20	.....	2.70	.....	2.30	.....	1.80	.45	.....	.60	.....	1.15

NOTE.—Gage heights for entire year refer to old gage.

Rating table for Humboldt River near Oreana, Nev., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.05	3	1.10	164	2.10	383	3.10	668
0.10	7	1.20	183	2.20	419	3.20	698
0.20	17	1.30	203	2.30	445	3.30	728
0.30	29	1.40	223	2.40	466	3.40	758
0.40	43	1.50	243	2.50	494	3.50	790
0.50	59	1.60	264	2.60	522	3.60	822
0.60	75	1.70	286	2.70	550	3.70	854
0.70	92	1.80	310	2.80	578	3.80	886
0.80	110	1.90	334	2.90	608	3.90	918
0.90	128	2.00	358	3.00	638	4.00	950
1.00	146						

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1904. It is well defined between gage heights 0.15 foot and 3.50 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Humboldt River near Oreana, Nev., for 1904.

[Drainage area, 13,800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	17	7	16.0	984	0.0012	0.0014
February	203	17	76.6	4,406	.0056	.0060
March	550	75	363	22,320	.026	.030
April	886	578	667	39,690	.048	.054
May	950	370	625	38,430	.045	.052
June	806	494	656	39,040	.048	.054
July	764	310	575	35,360	.042	.048
August	298	51	145	8,916	.011	.013
September	43	3	22.2	1,321	.0016	.0018
October	183	17	63.0	3,874	.0046	.0053
November	110	75	89.7	5,338	.0065	.0073
December	243	110	174	10,700	.013	.015
The year	950	3	289	210,400	.021	.288

HUMBOLDT RIVER (SOUTH FORK) NEAR ELKO, NEV.

The station, established August 29, 1896, by L. H. Taylor, is located 10 miles southwest of the town of Elko, at Cislini's (formerly Mason's) ranch, and about 6 miles above the junction of the South Fork with the main stream. The gage is inclined and spiked to posts driven firmly into the right bank. A new inclined gage was installed by E. C. Murphy November 22, 1902. It is at the site of the old one, the 4-foot marks of the old and new gages coinciding. The bench mark is a 4 by 4 inch timber driven 4 feet south of the gage. It is 6.29 feet above gage datum. The measurements are made from a cable and car at a point 1 mile above the gage, the latter being placed near the ranch of the observer, M. Cislini, for his convenience. At the point of measurement the banks are high, and the channel is straight for some distance above and below the station. The bed of the stream is composed of gravel and is stable. There is a good site for a reservoir a short distance above the station.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Humboldt River (South Fork) near Elko, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 22	W. A. Wolf	42	60	1.43	1.00	86
April 12	do	44	78	2.31	1.66	180
May 1	do	45	96	2.18	1.75	210
June 8	do	47	177	4.20	3.80	743
June 17	do	46	162	4.18	3.70	677
June 27	do	46	111	2.88	2.30	320
July 10	do	45	100	2.10	1.90	210
July 18	do	44	92	2.05	1.75	189
August 19	do	19	15	1.28	.50	19
September 15	do	16	13	1.36	.50	17
October 2	do	15	9.2	1.31	.40	12

Mean daily gage height, in feet, of Humboldt River (South Fork) near Elko, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.30	0.00	1.15	1.55	1.75	4.00	2.40	0.75	0.50	0.30	0.75	0.00
2	.30	.00	1.10	1.55	1.95	4.25	2.20	.65	.50	.40	.75	.00
3	.30	.00	1.10	1.40	2.02	4.25	2.20	.55	.50	.45	.75	.00
4	.30	.00	1.10	1.55	2.25	4.25	2.20	.45	.50	.45	.75	.00
5	.30	.00	1.05	1.35	2.25	4.12	2.00	.35	.50	.45	.75	.00
6	.30	.00	1.05	1.40	2.10	4.00	1.85	.30	.50	.45	.00	.00
7	.30	.10	1.05	1.40	2.10	4.00	1.85	.00	.50	.50	.00	.00
8	.30	.10	1.05	1.40	2.02	3.80	1.85	.00	.50	.50	.00	.00
9	.30	.10	1.05	1.40	1.95	4.00	1.75	.00	.50	.50	.00	.00
10	.00	.10	1.05	1.40	2.10	4.00	1.90	.00	.50	.50	.00	.00
11	.00	.10	1.05	1.48	2.25	4.00	1.85	.00	.50	.50	.00	.00
12	.00	.10	1.05	1.70	2.45	4.00	2.00	.00	.50	.50	.00	.00
13	.00	.10	1.05	1.70	2.45	4.00	2.20	.00	.50	.50	.00	.00
14	.00	.15	1.05	1.95	2.60	4.00	2.10	.00	.50	.50	.00	.00
15	.00	.20	1.05	1.95	2.60	3.90	1.70	3.10	.50	.50	.00	.00
16	.00	.25	1.05	2.02	2.70	3.90	1.55	.00	.50	.50	.00	.00
17	.00	.30	1.05	2.10	2.80	3.70	1.40	.40	.50	.50	.00	.00
18	.00	.30	1.05	2.10	3.05	3.80	1.75	.20	.50	.50	.00	.00
19	.00	.25	1.05	2.02	3.35	3.80	1.20	.50	.50	.50	.00	.00
20	.00	.20	1.05	1.95	3.55	3.67	1.10	.50	.50	.50	.00	.00
21	.00	.....	1.05	1.95	3.80	3.55	2.60	.30	.50	.50	.00	.00
22	.00	.....	1.05	1.95	4.00	3.35	2.40	.20	.50	.50	.00	.00
23	.00	.....	1.05	1.95	4.25	2.40	2.00	.20	.50	.60	.00	.00
24	.00	.....	.90	1.95	4.50	2.20	1.85	.20	.50	.60	.00	.00
25	.00	.....	.90	1.80	5.00	1.85	1.70	.20	.50	.75	.00	.00
26	.00	.....	.90	1.88	5.25	1.95	1.55	.20	.50	.75	.00	.00
27	.00	.....	1.00	1.95	4.75	2.20	1.40	.20	.50	.75	.00	.00
28	.00	.....	1.05	1.95	4.75	2.00	1.25	.20	.50	.75	.00	.00
29	.00	.....	1.70	1.80	4.50	2.20	1.10	.20	.50	.75	.00	.00
30	.00	.....	1.55	.....	4.25	2.40	.95	.20	.50	.75	.00	.00
31	.00	.....	1.55	.....	4.00	.....	.85	.20	.....	.75	.....	.00

Rating table for Humboldt River (South Fork) near Elko, Nev., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.00	2	1.40	133	2.80	444	4.10	815
.10	3	1.50	150	2.90	471	4.20	845
.20	5	1.60	168	3.00	498	4.30	876
.30	8	1.70	187	3.10	526	4.40	907
.40	12	1.80	207	3.20	554	4.50	938
.50	17	1.90	228	3.30	582	4.60	970
.60	24	2.00	249	3.40	610	4.70	1,002
.70	33	2.10	271	3.50	639	4.80	1,034
.80	44	2.20	293	3.60	668	4.90	1,067
.90	57	2.30	316	3.70	697	5.00	1,100
1.00	71	2.40	340	3.80	726	5.10	1,133
1.10	86	2.50	365	3.90	755	5.20	1,166
1.20	101	2.60	391	4.00	785	5.30	1,200
1.30	117	2.70	417				

The above table is applicable only for open-channel conditions. It is based upon 17 discharge measurements made during 1902 to 1904, inclusive, and is well defined.

Estimated monthly discharge of Humboldt River (South Fork) near Elko, Nev., for 1904.

[Drainage area, 1,150 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	8	2	3.7	228	0.0032	0.0037
February 1–20	8	2	3.8	151	.0033	.0024
March	187	57	85.8	5,276	.075	.086
April	271	125	198	11,780	.172	.192
May	1,183	197	556	34,190	.483	.557
June	860	218	635	37,780	.552	.616
July	391	50	207	12,730	.180	.208
August	526	2	24.9	1,531	.022	.025
September	17	17	17.0	1,012	.015	.017
October	38	8	21.4	1,316	.019	.022
November	38	2	8.0	476	.0070	.0078
December	2	2	2.0	123	.0017	.0020
The period				106,600		

PINE CREEK NEAR PALISADE, NEV.

This station was established November 27, 1902, by E. C. Murphy. It is located at the Eureka and Palisade Railroad bridge, 1 mile southwest of Palisade, Nev. The gage is a 1 by 4 inch vertical board spiked to the right abutment of the railroad bridge on the downstream side. It is read once each day by T. H. Jewell. Discharge measurements are made from the upstream side of the single-span railroad bridge at which the gage is located. The initial point for soundings is the right abutment. The channel is straight for 40 feet above and for 200 feet below the station. The current has a moderate velocity. The right bank is high and will not overflow. The left bank will overflow at extreme high water. There is but one channel at all stages, but during floods the entire flat on the left bank is under water. The bed of the stream is composed of gravel and sand and is shifting. The bench mark consists of a spike and three nails driven into the abutment near the gage. Its elevation is 7.00 feet above the zero of the gage.

The bed of the stream is so shifting that the station was abandoned December 31, 1904.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Pine Creek near Palisade, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square-feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 23	W. A. Wolf	17	9.5	1.72	1.80	16
April 13	do	8	3.5	1.98	1.82	6.9
May 4	do	9	4.7	1.90	1.85	8.9
June 6	do	11	8.3	1.65	1.75	14
June 16	do	10	5.9	1.71	1.65	10
June 27	do	4	1.4	1.43	1.70	2.0
July 8	do	6	2.0	1.50	1.75	3.0
August 17	do	4	1.6	1.17	1.40	1.9

Mean daily gage height, in feet, of Pine Creek near Palisade, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.20	2.00	2.05	2.30	1.80	1.80	1.70	1.65	1.90	2.10	1.90	1.80
2	2.20	2.00	2.00	2.10	2.20	1.80	1.70	1.70	1.90	2.10	1.90	1.80
3	2.15	1.95	2.00	2.05	2.20	1.80	1.70	1.70	1.90	2.20	1.90	1.80
4	2.10	1.95	2.00	2.00	2.20	1.80	1.70	1.70	1.90	2.20	1.90	1.80
5	2.00	1.90	1.95	2.00	2.30	1.80	1.70	1.70	1.90	2.20	1.90	1.80
6	1.90	1.90	1.95	2.00	2.20	1.75	1.70	1.70	1.90	2.20	1.90	1.80
7	1.80	1.80	1.95	1.90	2.10	1.70	1.70	1.70	1.90	2.20	1.90	1.75
8	1.70	1.85	1.95	1.85	2.10	1.70	1.70	1.70	1.90	2.20	1.90	1.75
9	1.60	1.90	1.95	1.85	2.10	1.65	1.70	1.70	1.90	2.20	1.90	1.75
10	1.60	1.95	1.95	1.85	2.05	1.60	1.65	1.70	1.90	2.25	1.90	1.75
11	1.60	2.00	1.95	1.85	2.05	1.60	1.65	1.65	1.90	2.25	1.90	1.75
12	1.60	2.05	1.95	1.85	2.00	1.60	1.65	1.65	1.90	2.50	1.90	1.75
13	1.60	2.10	1.95	1.85	1.95	1.60	1.65	1.65	1.90	2.50	1.90	1.70
14	1.60	2.00	1.95	1.85	1.90	1.60	1.65	1.70	1.90	2.50	1.90	1.70
15	1.60	2.10	1.95	1.85	1.85	1.60	1.65	1.70	1.90	2.50	1.90	1.70
16	1.60	2.20	1.95	1.80	1.85	1.60	1.65	2.50	1.90	2.35	1.85	1.70
17	1.60	2.50	1.95	1.80	1.85	1.65	1.65	2.50	1.90	2.30	1.85	1.70
18	1.65	2.50	1.95	1.80	1.85	1.65	1.65	2.20	1.90	2.25	1.85	1.70
19	1.70	2.30	1.95	1.70	1.90	1.65	1.65	1.90	1.90	2.20	1.85	1.70
20	1.80	2.20	1.95	1.60	1.90	1.65	1.65	1.80	1.95	2.10	1.85	1.70
21	1.90	2.20	1.95	1.60	1.90	1.65	1.65	1.80	1.95	2.00	1.85	1.70
22	2.00	2.40	1.95	1.60	1.80	1.65	1.65	1.80	2.00	1.90	1.85	1.70
23	2.10	2.90	1.95	1.60	1.80	1.65	1.65	1.75	2.10	1.90	1.85	1.70
24	2.10	3.10	2.00	1.60	1.80	1.65	1.65	1.75	2.10	1.90	1.85	1.70
25	2.10	2.50	2.00	1.60	1.80	1.70	1.65	1.75	2.10	1.90	1.85	1.70
26	2.10	2.30	2.00	1.70	1.80	1.70	1.65	1.75	2.10	1.90	1.85	1.70
27	2.10	2.10	2.00	1.70	1.80	1.70	1.65	1.70	2.10	1.90	1.80	1.70
28	2.10	2.10	2.10	1.70	1.80	1.70	1.65	1.75	2.10	1.90	1.80	1.70
29	2.10	2.10	2.20	1.80	1.80	1.70	1.65	1.80	2.10	1.90	1.80	1.70
30	2.10	.....	2.40	1.80	1.80	1.70	1.65	1.90	2.10	1.90	1.80	1.70
31	2.10	.....	2.50	.....	1.80	.....	1.65	1.90	.....	1.90	.....	1.70

TRUCKEE RIVER NEAR WADSWORTH, NEV.

This station was established November 6, 1902, by E. C. Murphy. It is located one-fourth mile west of the school at the Indian agency and 18 miles north of Wadsworth, Nev. The gage is a 4 by 4 inch vertical timber spiked to a cottonwood tree on the right bank. It is read twice each day by Joshua R. Bennett. Discharge measurements are made by means of a cable and car about 200 feet below the gage. The initial point for soundings is the zero of the tagged wire. The channel is straight for 200 feet above and below the cable and the current is swift. The right bank is low, and is liable to overflow beyond the cable support at very high water. The left bank is high and will not overflow. The bed of the stream is composed of sand and gravel and is permanent. There is but one channel at all stages. The bench mark consists of three nails driven into the root of a cottonwood tree 18 feet north of the gage. Its elevation is 12.07 feet above the zero of the gage. The gage was disturbed by a flood in early February, 1904, and settled 0.31 feet. The elevation of the bench mark is 12.38 feet above the zero of the present gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Truckee River near Wadsworth, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
April 3	W. A. Wolf	125	786	3.14	7.70	2,466
April 27	do	131	668	3.37	7.46	2,249
May 12	do	128	814	4.49	8.70	3,656
June 3	do	128	792	4.46	8.50	3,532
June 13	do	125	739	3.69	8.00	2,729
June 24	do	130	695	3.39	7.65	2,419
July 11	do	125	562	2.60	6.65	1,462
July 20	do	125	550	2.57	6.55	1,414
July 29	do	125	480	2.04	5.95	978
August 21	do	125	439	2.18	5.65	855
November 17	do	125	463	2.03	5.90	939

Mean daily gage height, in feet, of Truckee River near Wadsworth, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.00	4.60	6.80	.....	7.10	8.68	.....	.....	5.50	6.06	6.20	5.95
2	5.00	4.60	.....	7.85	7.10	8.68	.....	.....	5.50	6.25	6.18	6.00
3	5.00	4.60	7.40	7.75	7.17	8.58	.....	.....	5.49	6.04	6.15	6.00
4	5.00	4.60	7.62	7.66	7.16	8.56	.....	.....	5.41	5.98	6.15	5.92
5	5.15	4.60	.....	7.68	7.25	.....	.....	.....	5.49	6.02	6.10	5.80
6	5.00	4.60	.....	7.74	7.50	8.32	.....	.....	5.51	5.98	6.02	5.80
7	5.00	4.60	7.88	8.19	.....	8.44	.....	5.95	5.49	6.12	6.00	5.80
8	5.00	4.60	7.99	8.16	8.35	8.30	.....	5.85	5.50	5.94	6.00	5.75
9	5.00	4.60	8.26	8.20	8.49	8.28	.....	5.70	5.51	5.98	5.98	5.75
10	5.00	4.60	8.16	8.22	8.45	8.20	.....	5.70	5.47	5.98	5.98	5.80
11	5.00	4.60	8.06	8.46	8.59	8.19	.....	5.72	5.48	6.22	6.00	5.80
12	4.80	4.60	7.75	8.84	8.74	.....	.....	5.71	5.49	7.51	6.00	5.70
13	4.80	5.50	7.35	9.08	8.96	.....	.....	5.70	5.51	7.38	5.98	5.80
14	4.80	5.30	7.09	9.46	9.14	.....	.....	5.72	5.55	6.95	5.90	5.72
15	4.80	5.00	7.00	9.78	9.22	.....	.....	5.72	5.59	6.51	5.88	5.75
16	4.80	5.50	7.37	9.85	9.20	.....	.....	5.72	5.62	6.40	5.90	5.70
17	4.80	6.85	7.90	9.34	9.20	.....	.....	5.70	5.61	6.45	5.85	5.70
18	4.80	6.15	7.82	9.18	9.20	.....	.....	5.65	5.59	6.42	5.82	5.70
19	4.80	6.15	.....	9.06	9.13	.....	.....	5.64	5.65	6.41	5.85	5.70
20	4.60	6.15	9.50	9.08	8.85	.....	.....	5.64	5.72	6.32	5.88	5.75
21	4.60	.....	9.65	8.90	.....	.....	.....	5.60	5.65	6.30	5.95	5.70
22	4.60	7.15	9.54	.....	8.95	.....	.....	5.75	5.70	6.25	5.90	5.70
23	4.60	7.90	8.70	.....	9.11	.....	.....	5.80	5.78	6.25	5.90	5.70
24	4.60	8.50	8.14	7.87	9.24	.....	.....	5.65	5.90	6.20	5.85	5.70
25	4.60	8.70	7.80	7.73	9.28	.....	.....	5.64	6.12	6.19	5.80	5.65
26	4.80	.....	7.70	7.60	9.56	.....	.....	5.70	6.02	6.15	5.85	5.65
27	5.00	9.00	.....	7.42	9.00	.....	.....	5.90	6.00	6.15	5.80	5.80
28	5.00	8.70	.....	7.38	8.78	.....	.....	5.85	6.08	6.10	5.82	5.85
29	4.60	.....	.....	7.26	8.75	.....	.....	5.80	6.00	6.08	5.90	5.80
30	4.80	.....	8.10	7.20	8.72	.....	.....	5.70	6.02	6.05	5.92	5.78
31	4.60	.....	7.86	.....	8.66	.....	.....	5.65	.....	6.12	.....	6.70

NOTE.—Gage heights for entire year refer to new datum.

Rating table for Truckee River near Wadsworth, Nev., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.60	304	5.70	816	6.80	1,605	7.90	2,665
4.70	337	5.80	878	6.90	1,689	8.00	2,775
4.80	374	5.90	941	7.00	1,775	8.20	2,995
4.90	413	6.00	1,005	7.10	1,863	8.40	3,215
5.00	455	6.10	1,071	7.20	1,954	8.60	3,435
5.10	498	6.20	1,140	7.30	2,049	8.80	3,655
5.20	543	6.30	1,211	7.40	2,146	9.00	3,875
5.30	592	6.40	1,285	7.50	2,245	9.20	4,095
5.40	643	6.50	1,362	7.60	2,345	9.40	4,315
5.50	698	6.60	1,441	7.70	2,449	9.60	4,535
5.60	756	6.70	1,522	7.80	2,557		

The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1904. It is well defined between gage heights 5.90 feet and 9.00 feet. The table has been extended beyond these limits. Above gage height 8.00 feet the rating curve is a tangent, the difference being 110 per tenth.

Estimated monthly discharge of Truckee River near Wadsworth, Nev., for 1904.

[Drainage area, 2,130 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	520	304	392	24,100	0.184	0.212
February	3,875	304	1,300	74,780	.610	.658
March	4,590	1,605	2,736	168,200	1.28	1.48
April	4,810	1,954	3,132	186,400	1.47	1.64
May	4,491	1,863	3,414	209,900	1.60	1.84
June 1–11	3,523	2,984	3,242	70,730	1.52	.622
July						
August 7–31	973	756	833	41,310	.391	.364
September	1,085	649	799	47,540	.375	.418
October	2,255	966	1,214	74,650	.570	.657
November	1,140	878	974	57,960	.457	.510
December	1,522	786	884	54,360	.415	.478
The period				1,010,000		

NOTE.—From February to June, inclusive, the discharge for several days in each month has been interpolated.

TRUCKEE RIVER AT VISTA, NEV.

This station was originally established August 18, 1899, by L. H. Taylor. It is located 7 miles east of Reno, Nev., and one-fourth mile from the Southern Pacific Railroad station at Vista, Nev. On November 12, 1902, a new gage was installed on the left bank, 150 feet above the railroad bridge, by E. C. Murphy. Its zero has the same elevation as that of the original gage. On April 3, 1903, a new gage was established by D. W. Hays. It is located on the left bank and is a vertical 4 by 4 inch timber established on the same datum as the previous gages. On June 23, 1903, this gage was torn out and moved 3 feet farther into the river, in order to establish it in deeper water. The zero of the gage was lowered 2.72 feet. The gage is read once each day by M. Tuomey. Discharge measurements are made by means of a cable and car below the railroad bridge. The initial point for soundings is the zero of the tagged wire. The channel is straight for 150 feet above and 400 feet below the station. Both banks are high. The left bank is liable to overflow only at extreme high stages. There is but one channel at all stages. The bench mark is the head of a bolt set in the concrete on the upstream side of the left abutment of the Southern Pacific Railroad bridge, 300 feet from the gage. Its elevation is 19.74 feet above the zero of the gage.

On February 21, 1904, the gage rod was washed out by a flood. A new gage was established in the same position as the old gage, but with its zero 18.20 feet below bench mark.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Truckee River at Vista, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 11	W. A. Wolf	116	772	4.09	7.78	3,156
April 5	do	115	727	3.95	7.40	2,874
April 8	do	119	861	4.22	8.00	3,634
April 16	do	120	1,302	5.74	10.10	7,480
April 25	do	119	699	3.96	7.30	2,769
April 29	do	121	702	3.54	7.00	2,483
May 10	do	122	1,003	4.90	8.90	4,913
May 24	do	122	1,188	5.48	9.40	6,515
June 4	O. F. Heizer	126	932	4.12	8.40	3,832
June 11	do	120	814	3.91	8.00	3,185
June 18	do	117	756	3.77	7.60	2,849
June 25	do	113	664	3.19	7.00	2,119
July 2	do	129	662	3.01	6.70	1,993

Discharge measurements of Truckee River at Vista, Nev., in 1904—Continued.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
July 9	O. F. Heizer	120	570	2.61	6.20	1,490
July 16	do	118	535	2.28	5.80	1,220
July 19	do	118	589	2.26	5.90	1,334
July 23	do	117	524	2.16	5.70	1,130
July 30	do	117	490	1.80	5.20	880
August 7	do	117	490	1.76	5.10	865
August 13	do	116	485	1.53	4.90	742
August 20	do	116	470	1.70	5.00	798
August 28	do	116	488	1.69	5.10	823
September 7	W. A. Wolf	115	466	1.58	4.90	738
November 14	do	116	489	1.62	5.25	791

Mean daily gage height, in feet, of Truckee River at Vista, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.40	4.10	6.20	7.70	7.10	8.10	6.80	5.00	4.80	5.30	5.50	5.30
2	4.40	4.10	6.50	7.50	7.10	7.80	6.70	5.00	4.80	5.40	5.50	5.30
3	4.40	4.10	7.50	7.50	7.10	8.60	6.60	5.00	4.80	5.40	5.50	5.30
4	4.50	4.20	7.60	7.40	7.30	8.40	6.50	4.90	4.80	5.30	5.50	5.20
5	4.40	4.20	7.20	7.40	7.60	8.40	6.50	5.00	4.90	5.20	5.40	5.10
6	4.40	4.20	6.90	7.70	8.60	8.50	6.40	5.20	4.80	5.30	5.40	5.00
7	4.40	4.20	7.60	7.90	8.60	8.50	6.30	5.10	4.80	5.00	5.40	5.00
8	4.50	4.20	8.60	8.00	8.60	8.30	6.30	5.10	4.80	5.30	5.40	5.10
9	4.50	4.20	7.90	8.20	8.60	8.20	6.20	5.00	4.80	5.10	5.30	5.10
10	4.40	4.20	8.40	8.70	8.90	8.00	6.10	4.90	4.80	5.40	5.30	5.10
11	4.20	4.20	7.70	9.00	9.00	8.00	6.00	4.90	4.80	5.60	5.30	a5.10
12	4.20	5.00	7.20	9.40	9.30	8.00	5.90	4.90	4.80	6.80	5.30	a5.10
13	4.30	4.90	6.70	9.80	9.60	8.00	5.90	4.90	4.80	6.10	5.30	a5.05
14	4.30	4.50	6.60	10.50	9.70	7.90	5.90	4.90	4.80	5.80	5.30	a5.05
15	4.30	4.70	6.60	10.70	9.70	7.80	5.80	4.90	4.90	5.90	5.30	a5.00
16	4.30	7.00	6.90	10.10	9.70	7.80	5.80	4.90	4.95	5.80	5.20	a5.00
17	4.10	6.00	8.10	9.50	9.70	7.70	5.70	4.90	4.90	5.70	5.20	a5.00
18	4.20	5.30	8.10	9.30	9.50	7.60	5.80	4.90	5.00	5.60	5.30	5.00
19	4.20	5.10	9.10	9.40	9.00	7.50	5.90	4.90	4.90	5.70	5.30	5.00
20	4.30	4.90	10.40	8.30	8.70	7.40	5.70	4.90	4.90	5.60	5.20	5.00
21	4.20	4.80	9.40	8.10	8.70	7.40	5.60	4.90	4.90	5.60	5.20	5.00
22	4.20	8.30	8.80	7.90	8.80	7.40	5.70	4.80	5.00	5.60	5.20	5.00
23	4.20	9.30	8.20	7.50	8.90	7.40	5.70	4.80	5.10	5.20	5.20	5.00
24	4.20	a9.30	7.50	7.40	9.10	7.20	5.60	4.90	5.40	5.10	5.20	5.10
25	4.20	a9.40	7.40	7.30	10.00	7.00	5.60	4.90	5.40	5.00	5.20	5.00
26	4.20	9.40	7.20	7.40	9.60	7.00	5.50	5.00	5.30	5.30	5.10	5.00
27	4.20	8.30	7.20	7.10	8.90	6.90	5.40	5.10	5.30	5.40	5.20	5.20
28	4.20	7.10	8.60	7.00	8.90	6.90	5.30	5.00	5.30	5.50	5.20	5.00
29	4.20	6.30	9.30	7.00	8.80	6.90	5.20	4.90	5.30	5.50	5.30	5.00
30	4.20	.....	8.50	7.00	8.70	6.90	5.20	4.90	5.30	5.50	5.30	5.50
31	4.10	.....	7.90	.....	8.50	.....	5.10	5.10	.....	5.50	.....	6.00

a Interpolated.

NOTE.—Gage heights for entire year refer to new datum.

Rating table for Truckee River at Vista, Nev., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.10	535	5.60	1,085	7.10	2,360	8.60	4,485
4.20	553	5.70	1,147	7.20	2,470	8.70	4,675
4.30	574	5.80	1,212	7.30	2,585	8.80	4,870
4.40	598	5.90	1,282	7.40	2,705	8.90	5,070
4.50	624	6.00	1,355	7.50	2,830	9.00	5,270
4.60	652	6.10	1,432	7.60	2,955	9.20	5,670
4.70	683	6.20	1,512	7.70	3,085	9.40	6,090
4.80	716	6.30	1,595	7.80	3,220	9.60	6,520
4.90	751	6.40	1,681	7.90	3,360	9.80	6,960
5.00	789	6.50	1,770	8.00	3,505	10.00	7,400
5.10	830	6.60	1,862	8.10	3,655	10.20	7,840
5.20	874	6.70	1,957	8.20	3,810	10.40	8,280
5.30	922	6.80	2,055	8.30	3,970	10.60	8,720
5.40	973	6.90	2,155	8.40	4,135		
5.50	1,027	7.00	2,255	8.50	4,305		

The above table is applicable only for open-channel conditions. It is based upon 23 discharge measurements made during 1904. It is well defined between gage heights 4.90 and 6.70 feet. Above 6.70 feet gage height the measurements are too scattered for an accurate curve.

Estimated monthly discharge of Truckee River at Vista, Nev., for 1904.

[Drainage area, 1,519 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	624	535	572	35,170	0.377	0.435
February	6,090	535	1,777	102,200	1.17	1.26
March	8,280	1,512	3,431	211,000	2.26	2.61
April	8,940	2,255	4,172	248,200	2.75	3.07
May	7,400	2,360	4,924	302,800	3.24	3.74
June	4,485	2,155	3,174	188,900	2.09	2.33
July	2,055	830	1,313	80,730	.864	.996
August	874	716	771	47,410	.508	.586
September	973	716	785	46,710	.517	.577
October	2,055	789	1,049	64,500	.691	.797
November	1,027	830	924	54,980	.608	.678
December	1,355	789	844	51,900	.556	.641
The year	8,940	535	1,978	1,435,000	1.30	17.72

TRUCKEE RIVER AT NEVADA-CALIFORNIA STATE LINE.

This station was originally established September 7, 1899, by L. H. Taylor. It is located at the State line, 17 miles west of Reno, Nev. The original gage was vertical, driven into the bed of the river and wired to a granite bowlder. On November 11, 1902, a new gage was established by E. C. Murphy. It is located on the right bank, 400 feet below the point at which the old gage was located, and consists of two sections of 4 by 4 inch timber. The upper section is vertical, and is spiked to a cottonwood tree. The lower section is inclined, and is immediately under the vertical section. The gage datum is the same as that of the old gage. The gage is read once each day by H. E. Dickinson. Discharge measurements are made by means of a cable and car 2½ miles below the gage at Linham Siding, and 100 feet below Bridge No. 2. The initial point for soundings is the zero of the tagged wire. The channel is straight for 60 feet above and for 75 feet below the cable. The current is swift. Both banks are high and rocky and are not liable to overflow. The bed of the stream is composed of bowlders and cobblestones. The bench mark consists of two spikes driven into the root of the cottonwood tree, to which the vertical section of the gage is attached. Its elevation is 5.99 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Truckee River at Nevada-California State line, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 6	W. A. Wolf	96	539	4.67	4.40	2,518
April 23	do	90	470	4.85	4.20	2,279
May 11	do	92	653	5.96	5.75	3,892
May 31	do	91	452	4.82	4.10	2,179
June 14	do	91	523	5.69	4.80	2,977
June 18	do	91	533	5.49	4.60	2,927
July 1	O. F. Heizer	91	473	4.17	3.95	1,972
July 14	do	83	416	3.51	3.35	1,461
August 4	do	80	368	3.01	2.95	1,109
August 18	do	80	360	2.92	2.85	1,053
August 31	W. A. Wolf	80	313	2.68	2.70	839
November 19	do	80	321	2.05	2.70	658

Mean daily gage height, in feet, of Truckee River, at Nevada-California State line, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.05	1.90	3.15	4.22	4.15	4.85	3.95	3.00	2.65	2.95	2.85	2.75
2	2.00	2.00	3.25	4.10	4.15	5.30	3.80	.....	2.65	2.80	2.95	2.75
3	2.00	1.95	4.25	4.15	4.15	5.35	3.70	3.00	2.65	2.75	2.85	2.74
4	2.50	1.90	4.20	4.15	4.40	5.22	3.80	2.95	.....	2.75	2.80	.....
5	2.30	1.85	4.00	4.20	4.68	.....	3.80	3.15	2.95	2.78	2.80	2.75
6	2.30	1.90	3.88	4.60	4.95	5.25	3.72	3.00	2.65	2.80	2.80	2.75
7	2.15	2.00	4.77	4.40	5.35	5.00	3.58	2.85	2.70	2.52	2.80	2.70
8	2.12	2.00	5.00	.....	5.35	4.85	3.60	2.92	2.70	2.55	2.78	2.60
9	2.15	2.00	4.30	4.65	5.35	4.85	3.55	.....	2.72	2.60	2.80	2.65
10	2.15	2.00	4.20	5.05	5.68	4.85	3.50	2.90	2.70	.....	.....	2.65
11	1.95	1.90	4.00	5.45	5.75	4.82	3.45	2.90	2.72	3.75	2.85	2.60
12	1.92	2.05	3.85	5.75	5.95	4.78	3.40	2.90	2.70	3.40	2.68	2.60
13	1.90	1.90	3.85	6.20	6.12	4.75	3.20	2.85	.....	3.10	2.65	2.60
14	2.00	2.05	3.55	6.48	6.50	4.75	3.40	.....	2.80	2.95	2.60	2.60
15	2.05	2.05	3.50	6.25	6.08	4.75	3.38	2.90	2.70	3.05	2.60	2.60
16	2.10	3.80	3.65	5.70	6.02	4.72	3.30	2.90	2.70	3.10	2.65	2.60
17	2.05	3.60	3.90	5.42	6.02	4.65	3.35	2.85	2.75	3.10	2.65	2.50
18	2.00	2.85	5.15	5.42	5.72	4.60	3.35	2.90	2.75	3.00	.....	2.50
19	1.95	2.80	6.20	5.45	5.30	4.40	3.25	2.90	2.80	.....	2.70	2.50
20	1.80	2.60	6.50	4.85	5.28	4.30	3.30	2.90	2.80	2.85	.....	2.60
21	2.00	2.50	4.92	4.58	5.40	4.30	3.30	3.15	2.75	2.90	2.70	2.60
22	2.00	4.95	4.90	4.40	6.10	4.47	3.30	2.85	2.75	2.90	2.70	2.55
23	1.90	6.30	4.50	4.22	6.15	4.35	3.25	2.75	2.75	2.62	2.65	2.55
24	1.95	8.00	4.05	4.15	6.20	4.35	3.25	2.75	2.70	2.60	2.62	2.55
25	1.90	5.50	3.90	4.15	6.42	4.15	3.25	2.75	2.85	2.55	2.60	2.55
26	2.00	5.00	3.90	3.95	5.95	.....	3.25	2.75	.....	2.55	2.60	2.55
27	1.80	4.00	3.85	4.10	5.12	4.08	.....	2.70	2.65	2.55	2.70	2.55
28	1.85	3.50	5.10	4.02	5.28	4.10	3.15	2.70	.....	2.90	2.75	2.55
29	1.60	3.15	5.35	4.05	5.30	4.10	3.15	2.70	2.75	2.90	2.70	2.55
30	1.75	.....	5.12	4.02	5.40	4.05	3.00	2.70	2.75	2.90	2.65	3.30
31	1.90	.....	4.28	.....	5.25	.....	2.95	2.65	.....	2.90	.....	2.85

Rating table for Truckee River at Nevada-California State line, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	230	2.80	956	4.00	2,070	5.20	3,370
1.70	271	2.90	1,040	4.10	2,170	5.30	3,490
1.80	314	3.00	1,126	4.20	2,270	5.40	3,610
1.90	361	3.10	1,213	4.30	2,370	5.50	3,730
2.00	412	3.20	1,302	4.40	2,470	5.60	3,850
2.10	467	3.30	1,393	4.50	2,580	5.70	3,970
2.20	526	3.40	1,486	4.60	2,690	5.80	4,090
2.30	589	3.50	1,580	4.70	2,800	5.90	4,210
2.40	656	3.60	1,676	4.80	2,910	6.00	4,330
2.50	725	3.70	1,772	4.90	3,020	6.20	4,570
2.60	798	3.80	1,870	5.00	3,130	6.40	4,810
2.70	875	3.90	1,970	5.10	3,250		

The above table is applicable only for open-channel conditions. It is based upon 15 discharge measurements made during 1903 and 1904. It is well defined between gage heights 2.10 feet and 5.75 feet. The table has been extended beyond these limits. Above gage height 5.00 feet the rating curve is a tangent, the difference being 120 per tenth.

Estimated monthly discharge of Truckee River at Nevada-California State line, for 1904.

[Drainage area, 955 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	725	230	419	25,760	0.439	0.506
February	6,730	337	1,351	77,710	1.41	1.52
March	4,930	1,257	2,469	151,800	2.59	2.99
April	4,906	2,020	2,897	172,400	3.03	3.38
May	4,930	2,220	3,706	227,900	3.88	4.47
June	3,550	2,120	2,751	163,700	2.88	3.21
July	2,020	1,083	1,497	92,050	1.57	1.81
August	1,257	836	1,017	62,530	1.06	1.22
September	1,083	836	903	53,730	.946	1.06
October	1,821	739	1,029	63,270	1.08	1.24
November	1,083	798	893	53,140	.935	1.04
December	1,393	725	834	51,280	.873	1.01
The year	6,730	230	1,647	1,195,000	1.72	23.46

NOTE.—Missing gage heights interpolated.

TRUCKEE RIVER AT TAHOE, CAL.

Truckee River, the natural outlet of Lake Tahoe, leaves the lake at the city of Tahoe. About 500 feet from the lake there is a timber dam across the river, which has been maintained for more than twenty years, for the purpose of controlling the discharge from the lake. June 17, 1900, a gage was placed in the stream for the purpose of recording the height of the water in the river. The gage is a vertical timber driven into the stream bed at the left bank about 300 feet below the dam, and is spiked to the root of a cottonwood tree growing on the bank. On November 18, 1902, a new gage was established by E. C. Murphy in the exact position of the old gage. It is a 4 by 4 inch vertical timber. The elevation of its zero is the same as that of the old gage. The bench mark is cut in the side of the tree and is 4.00 feet above gage datum. The measurements are made from a cable and car about one-fourth mile below the gage, which was placed as near the city of Tahoe as possible for the convenience of the observer. At the point of measurement the right bank is low and is subject to overflow at very high stages of the stream. The left bank is rather high. The channel is nearly straight for 300 feet above and below the station, and the bed of the river, which is of gravel and coarse sand, is smooth and stable. The current has a moderate velocity. During June, 1904, a new cable was put in 1 mile below the gage. The purpose of the station is to ascertain the actual overflow from Lake Tahoe with a view to determining its real value as a storage reservoir.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Truckee River at Tahoe, Cal., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 20	W. A. Wolf	118	306	2.93	3.50	899
July 2	do	118	306	2.86	3.35	875
July 14	do	118	363	2.42	3.35	879
July 22	do	118	351	2.44	3.35	856
August 14	do	118	344	2.38	3.20	818
August 30	do	118	308	2.18	2.85	674
November 15	do	118	314	2.26	2.90	711

Mean daily gage height, in feet, of Truckee River at Tahoe, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.90	1.40	0.10	2.50	3.10	3.55	3.50	3.30	2.85	3.00	3.00	2.80
2	1.90	1.40	.10	2.50	3.10	3.45	3.40	3.30	2.85	3.10	3.00	2.75
3	1.90	1.40	.10	2.50	3.10	3.35	3.40	3.30	2.95	3.10	3.00	2.75
4	1.90	1.40	.10	2.50	3.10	3.30	3.40	3.30	3.45	3.10	3.00	[a] 2.75
5	1.90	1.40	.10	2.50	3.10	3.40	3.40	3.30	2.85	3.10	3.00	[a] 2.70
6	1.90	1.40	1.30	2.50	3.10	3.40	3.40	3.25	3.00	2.20	3.00	2.70
7	1.90	.40	1.30	2.50	3.10	3.40	3.40	3.25	3.00	2.20	3.00	2.65
8	1.90	.40	1.30	2.50	3.10	3.40	3.40	3.25	3.15	2.20	3.00	2.65
9	1.90	.40	1.30	2.50	3.10	3.40	3.40	3.25	3.15	2.20	3.00	2.65
10	1.40	.40	1.90	2.50	3.10	3.40	3.30	3.25	3.15	2.20	3.00	2.60
11	1.40	.40	1.90	2.50	3.10	3.40	3.30	3.25	3.15	2.20	3.00	2.60
12	1.70	.90	1.90	2.50	3.10	3.40	3.30	3.25	3.15	2.50	3.00	2.60
13	1.60	1.50	1.90	2.50	3.10	3.40	3.30	3.25	3.15	2.50	3.00	2.60
14	1.60	.60	1.90	2.50	3.10	3.40	3.40	3.20	3.15	3.10	3.00	2.60
15	1.60	.60	2.50	2.50	3.10	3.50	3.40	3.30	3.10	3.10	3.00	2.60
16	1.60	1.01	2.50	2.50	3.10	3.50	3.40	3.30	3.10	3.10	2.90	2.60
17	1.60	1.01	2.50	2.60	3.15	3.50	3.50	3.30	3.10	3.10	2.90	2.55
18	1.60	1.01	2.50	2.60	3.15	3.50	3.50	3.30	3.00	3.00	2.85	2.55
19	1.40	.90	2.50	2.60	3.15	3.55	3.45	3.20	3.10	3.00	2.85	2.55
20	1.40	.90	2.50	2.60	3.15	3.55	3.45	3.20	3.10	3.15	2.85	2.55
21	1.40	.10	2.50	2.60	3.15	3.55	3.40	3.20	3.10	3.15	2.85	2.55
22	1.40	.10	2.50	2.60	3.15	3.55	3.40	2.90	3.10	2.40	2.85	2.55
23	1.40	.10	2.50	2.60	3.15	3.55	3.40	2.90	3.10	2.40	2.85	2.55
24	1.40	.10	2.50	2.70	3.30	3.50	3.40	2.90	3.10	2.40	2.80	2.55
25	1.40	.10	2.50	2.80	3.30	3.50	3.40	2.90	3.00	2.80	2.80	2.60
26	1.40	.10	2.50	2.80	3.30	3.40	3.35	2.90	3.00	2.80	2.80	2.60
27	1.40	.10	2.30	2.80	3.25	3.50	3.35	2.90	3.00	3.10	2.80	2.60
28	1.40	.10	2.30	2.80	3.25	3.50	3.35	2.90	3.00	3.10	2.80	2.60
29	1.40	.10	2.30	3.10	3.25	3.50	3.35	2.85	3.00	3.10	2.80	2.60
30	1.40	.....	2.40	3.10	3.55	3.50	3.35	2.85	3.00	3.10	2.80	2.65
31	1.40	.....	2.40	.....	3.55	.....	3.35	2.85	.....	3.10	.....	2.70

[a] Interpolated.

Rating table for Truckee River at Tahoe, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.10	13	1.10	181	2.10	450	3.10	773
0.20	24	1.20	204	2.20	480	3.20	807
0.30	37	1.30	228	2.30	510	3.30	841
0.40	51	1.40	253	2.40	542	3.40	877
0.50	66	1.50	279	2.50	574	3.50	913
0.60	82	1.60	305	2.60	606	3.60	949
0.70	100	1.70	333	2.70	638	3.70	985
0.80	119	1.80	361	2.80	671	3.80	1,021
0.90	139	1.90	390	2.90	705	3.90	1,057
1.00	159	2.00	420	3.00	739		

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1902 to 1904, inclusive. It is well defined between gage heights 0.10 foot and 3.50 feet. The table has been extended above gage height 3.50 feet.

Estimated monthly discharge of Truckee River at Tahoe, Cal., for 1904.

[Drainage area, 519 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	390	253	305	18,750	0.588	0.678
February	253	13	111	6,385	.214	.231
March	574	13	401	24,660	.773	.891
April	773	574	610	36,300	1.18	1.32
May	931	773	799	49,130	1.54	1.78
June	931	841	899	53,490	1.73	1.93
July	913	841	873	53,680	1.68	1.94
August	841	688	787	48,390	1.52	1.75
September	895	688	761	45,280	1.47	1.64
October	790	480	672	41,320	1.29	1.49
November	739	671	711	42,310	1.37	1.53
December	671	590	614	37,750	1.18	1.36
The year	931	13	629	457,400	1.21	16.54

LAKE WINNEMUCCA INLET NEAR WADSWORTH, NEV.

This station was established November 7, 1902, by E. C. Murphy. It is located 3 miles north of Pyramid Lake Indian School and 21 miles north of Wadsworth, Nev. The gage is a 4 by 4 inch vertical timber spiked to a willow tree on the right bank. It is read three times each week by J. R. Bennett. The discharge measurements are made by means of a cable and car near the gage. The initial point for soundings is the zero of the tagged wire. The channel is straight for 150 feet above and below the cable, and the current is moderate. Both banks are high and not subject to overflow. The bed is composed of gravel and silt and may change slightly. There is but one channel at all stages. The bench mark consists of two spikes driven into the willow tree to which the gage is attached. Its elevation is 6.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Lake Winnemucca Inlet near Wadsworth, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 15	W. A. Wolf	51	143	1.68	4.50	240
April 4	do	53	185	1.93	5.00	358
May 12	do	58	226	1.93	7.22	437
June 3	do	53	228	2.00	6.00	457
June 13	do	53	183	1.92	5.00	352
June 24	do	51	151	1.92	4.40	290
July 11	do	44	93	1.47	2.90	137
July 20	do	43	83	1.42	2.70	118
July 29	do	42	71	1.26	2.50	89
August 21	do	41	65	1.26	2.40	83
November 18	do	44	95	1.40	3.00	142

Mean daily gage height, in feet, of Lake Winnemucca Inlet near Wadsworth, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			2.20	5.90	6.77	5.00					2.88	
2		1.60					2.20		2.75	2.77		2.77
3	1.80			4.55	6.55	6.77						
4			1.90	5.00					2.70	2.90	2.70	2.88
5	1.88	1.88		4.99		6.40	2.30					
6			1.70		5.66				2.68	2.66	2.88	2.78
7		1.66				6.50				2.99		
8	1.50		5.88	5.77	4.55		2.40				2.80	2.77
9		1.80						2.80		2.99		
10	1.55			8.66	4.88	6.35	3.00		2.68			2.80
11			5.70							2.99	2.77	2.80
12	1.88	1.77		8.99	7.22	6.00	3.80	2.80				
13			5.66		5.66				2.88	2.88	2.60	2.55
14		1.55				5.77				2.77		
15	1.80		5.99	6.55	4.99		3.40				2.88	2.60
16		1.77						2.66		2.99		
17	1.99			4.88	4.77	5.55	2.70		2.99		2.99	2.60
18			3.80						2.77	2.77	2.99	2.77
19	1.77	5.88		8.77			2.60	2.66		2.90	2.66	
20			2.50		5.66				2.70		2.88	
21		6.77						2.74		2.88	2.66	2.77
22	1.88		4.66	5.88	5.77		2.50					
23		2.66						2.88	2.77	2.56	2.88	2.55
24	1.70			5.66	6.99		2.50				2.77	2.55
25			5.77					2.90		2.70		2.88
26	1.60	2.77		6.55			2.50		2.86			2.77
27			4.70		8.77			2.99		2.88	2.99	2.77
28		2.99							2.88			2.66
29	1.88		6.55	5.99	8.55		2.40	2.88		2.66	2.88	
30									2.88		2.66	2.66
31	1.66				7.66		2.30	2.77				2.98

Rating table for Lake Winnemucca Inlet near Wadsworth, Nev., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	16	3.00	145	4.50	300	6.00	458
1.60	22	3.10	155	4.60	311	6.20	479
1.70	28	3.20	165	4.70	321	6.40	500
1.80	34	3.30	175	4.80	332	6.60	522
1.90	41	3.40	185	4.90	342	6.80	544
2.00	49	3.50	196	5.00	353	7.00	565
2.10	57	3.60	206	5.10	363	7.20	586
2.20	65	3.70	217	5.20	374	7.40	607
2.30	74	3.80	227	5.30	384	7.60	629
2.40	84	3.90	237	5.40	395	7.80	650
2.50	94	4.00	248	5.50	405	8.00	672
2.60	104	4.10	258	5.60	416	8.20	693
2.70	114	4.20	269	5.70	426	8.40	714
2.80	124	4.30	279	5.80	437	8.60	735
2.90	134	4.40	290	5.90	447	8.80	756

The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements made during 1904. It is well defined between gage heights 2.20 feet and 6.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Lake Winnemucca Inlet near Wadsworth, Nev., for 1904.

Month.	Mean discharge in second-feet.	Total in acre-feet.[a]
January, 13 days	31.9	1,961
February, 12 days	130	7,478
March, 13 days	292	17,950
April, 14 days	490	29,160
May, 15 days	490	30,130
June, 14 days	365	21,720
July, 13 days	111	6,825
August, 10 days	125	7,686
September, 12 days	124	7,379
October, 16 days	127	7,809
November, 17 days	126	7,498
December, 19 days	117	7,194
The year		152,400

[a] Acre-feet computed for entire month.

LITTLE TRUCKEE RIVER NEAR PINE STATION, CAL.

The station was established June 25, 1903, by George B. Lorenz. The cable station is located about one-fourth of a mile upstream from Bruhn's mill, known also as Pine Station. The dam at this point backs the water up for about 300 yards. The road which follows the Little Truckee north from Boca crosses the river at a ford about 150 feet below the cable and the same distance above the gage rod. Pine Station, on the Boca and Loyalton Railroad, about one-fourth of a mile distant, is the nearest railroad point. The gage rod is located about 300 feet below the cable, and consists of a vertical 2 by 6 inch board graduated to feet and tenths from zero to 4 feet. The gage is read twice each day by S. Wallace. Discharge measurements are made from a three-eighths inch steel cable and car, 5½ feet above the high-water level. A tag wire is stretched just above the cable. The initial point for soundings is the post which supports the cable on the left or north bank. Above the station the channel is straight for 100 feet at high water and for 30 feet at low water. Below the station the channel is straight for 200 feet at high and low water. The current is swift at all stages. The right or south bank is high, steep, and rocky, and is not subject to overflow. It supports some underbrush and a few trees. The left or north bank is composed of gravel for 40 feet back from the high-water channel. It is low and may be overflowed. The bed of the stream consists of coarse gravel and is free from vegetation. There is but one channel at all stages.

The bench mark is the head of a large nail driven into a 2 by 4 inch timber set in the ground in a clump of small willows 8 feet from the gage. The willows surrounding the bench mark are blazed and marked "B. M., U. S. G. S." Its elevation is 4.83 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Little Truckee River near Pine Station, Cal., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 27	W. A. Wolf	90	215	4.52	3.10	971
June 12	do	84	194	3.90	2.90	757
June 21	do	74	153	4.03	2.50	617
July 5	do	68	108	2.97	1.88	321
July 16	do	65	92	2.01	1.60	185
August 12	do	55	44	1.08	.85	48
September 1	do	55	41	1.02	.75	42

Mean daily gage height, in feet, of Little Truckee River near Pine Station, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.12	1.44	2.50	2.69	2.46	2.94	2.16	1.04	0.65	1.02	1.00	1.26
2	1.12	1.40	2.80	2.70	2.48	2.92	2.08	1.06	.65	.94	1.00	1.22
3	1.25	1.40	2.82	2.66	2.55	3.06	2.04	1.03	.63	.82	1.00	1.13
4	1.30	1.45	2.85	2.72	2.76	2.98	1.96	1.02	.63	.80	.98	1.10
5	1.40	1.37	2.72	2.82	2.94	2.99	1.88	1.00	.63	.78	.95	1.07
6	1.38	1.42	2.75	2.92	3.16	3.06	1.90	.99	.63	.80	.94	1.12
7	1.40	1.45	2.90	3.09	3.20	3.05	1.92	.98	.62	.95	.92	1.10
8	1.50	1.53	3.10	3.23	3.30	2.86	1.88	.95	.60	.99	.90	1.14
9	1.45	1.60	2.82	3.49	3.32	2.85	1.80	.93	.60	1.04	.90	1.00
10	1.18	1.60	2.75	3.64	3.46	2.84	1.76	.92	.60	1.28	.89	.90
11	1.28	1.60	2.45	3.84	3.44	2.85	1.64	.85	.60	2.34	.88	.75
12	1.30	1.50	2.32	4.07	3.60	2.78	1.60	.83	.60	2.16	.88	.76
13	1.25	1.40	2.29	4.48	3.75	2.80	1.56	.82	.60	1.80	.86	.78
14	1.32	1 54	2.28	4.56	3.64	2.84	1.59	.80	.60	1.58	.85	.76
15	1.48	1.90	2.25	4.32	3.64	2.75	1.56	.83	.62	1.36	.90	.75
16	1.42	2.42	2.18	3.95	3.60	2.72	1.62	.80	.63	1.28	.86	.68
17	1.42	2.58	2.35	3.74	3.56	2.65	1.56	.80	.63	1.20	.88	.85
18	1.36	2.54	2.95	3.86	3.38	2.60	1.52	.80	.66	1.12	.92	.86
19	1.40	2.56	3.55	3.72	3.12	2.50	1.48	.78	.63	1.10	.86	.78
20	1.52	2.28	3.65	3.15	3.08	2.44	1.42	.76	.63	1.06	.89	.78
21	1.48	2.18	3.35	2.95	3.22	2.45	1.39	.73	.60	1.05	.86	.76
22	1.56	2.75	3.06	2.80	3.48	2.46	1.38	.70	.68	1.04	.88	.73
23	1.48	3.25	2.82	2.60	3.62	2.48	1.32	.70	.82	1.04	.84	.68
24	1.48	3.75	2.60	2.55	3.73	2.39	1.32	.79	1.08	1.03	.85	.54
25	1.42	3.65	2.49	2.59	3.82	2.29	1.33	.84	.95	1.03	.85	.60
26	1.39	3.35	2.45	2.58	3.32	2.20	1.26	.80	.89	1.03	.86	.78
27	1.40	2.90	2.50	2.44	3.08	2.22	1.22	.74	.84	1.03	.95	1.11
28	1.39	2.62	3.08	2.34	3.02	2.26	1.18	.72	.80	1.00	1.05	1.24
29	1.38	2.60	3.14	2.35	3.06	2.26	1.13	.69	.80	1.00	.99	1.15
30	1.40	.....	2.89	2.45	3.10	2.22	1.10	.68	.82	1.00	1.14	1.50
31	1.38	.....	2.76	.....	3.04	.....	1.06	.66	.....	1.00	.....	1.14

Rating table for Little Truckee River near Pine Station, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.60	31	1.70	240	2.70	708	3.70	1,265
.70	37	1.80	278	2.80	761	3.80	1,325
.80	45	1.90	318	2.90	815	3.90	1,385
.90	53	2.00	361	3.00	869	4.00	1,445
1.00	64	2.10	407	3.10	923	4.10	1,510
1.10	79	2.20	455	3.20	978	4.20	1,575
1.20	98	2.30	504	3.30	1,034	4.30	1,640
1.30	120	2.40	554	3.40	1,090	4.40	1,705
1.40	145	2.50	604	3.50	1,146	4.50	1,770
1.50	174	2.60	656	3.60	1,205	4.60	1,835
1.60	205						

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904. It is well defined between gage heights 0.75 foot and 3.10 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Little Truckee River near Pine Station, Cal, for 1904.

[Drainage area, 166 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	192	83	140	8,608	0.843	0.972
February	1,295	137	467	26,860	2.81	3.03
March	1,235	445	742	45,620	4.47	5.15
April	1,809	524	981	58,370	5.91	6.59
May	1,337	584	1,013	62,290	6.10	7.03
June	901	455	688	40,940	4.14	4.62
July	436	73	209	12,850	1.26	1.45
August	73	35	49.3	3,031	.297	.342
September	76	31	37.8	2,249	.228	.254
October	536	43	115	7,071	.693	.799
November	86	48	55.6	3,308	.335	.374
December	174	28	64.6	3,972	.389	.448
The year	1,809	28	380	275,000	2.29	31.06

INDEPENDENCE CREEK BELOW INDEPENDENCE LAKE, CAL.

This station was established October 24, 1902, by E. C. Murphy. It is located about one-eighth of a mile below the dam at the lower end of Independence Lake, California. The original gage was a vertical 4 by 4 inch timber, located about 200 feet upstream from the cable and car from which the measurements are made. For the convenience of the observer, a new vertical gage, made of 2 by 4 inch timber, was established July 1, 1904, on the left bank of the stream 75 feet below the outlet of the lake. Simultaneous readings taken upon the two gages give identical results for the fluctuations of 1904. The gage is read twice daily by F. A. Connor. The channel is straight for 50 feet above and below the station. The banks are low but not subject to overflow. The bed of the stream is permanent, being composed of gravel and clay, but during high water large quantities of sand are washed down the stream. The current is moderately rapid, and the discharge is controlled by the dam at the end of the lake. The bench mark for the original gage is three nails driven in the root of a pine tree 55 feet northwest of the gage. Its elevation is 5.82 feet above the zero of the gage. The bench mark for the new gage is the head of four nails driven into the tree stump to which the new gage rod is fastened. Its elevation is 3.00 feet above the zero of the new gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Independence Creek below Independence Lake, Cal., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet	*Sq. feet.*	*Ft. per. sec.*	*Feet.*	*Sec.-feet.*
June 17	A. E. Chandler	29	62	1.98	3.15	123
July 1	W. A. Wolf	28	60	1.62	3.08	97
July 13	do	28	52	.90	2.75	47
July 23	do	13	7.8	1.69	2.30	13
August 29	do	6	3.0	.77	1.80	3
November 16	do	6	4.2	1.23	2.05	5

Mean daily gage height, in feet, of Independence Creek below Independence Lake, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.52	1.69	2.69	2.13	2.12	3.15	3.10	2.25	1.80	1.80	2.15	3.20
2	1.55	1.69	2.47	2.12	2.14	3.12	3.02	2.25	1.80	1.80	2.10	3.10
3	1.52	1.70	2.26	2.11	2.14	3.10	3.00	2.25	1.80	1.80	2.10	3.10
4	1.60	1.70	2.30	2.10	2.18	3.14	2.95	2.25	1.80	1.80	2.10	3.10
5	1.59	1.72	2.30	2.10	2.18	3.15	2.88	2.25	1.80	1.85	2.10	2.90
6	1.59	.....	2.30	2.10	2.39	3.20	2.85	2.25	1.80	1.90	2.10	2.85
7	1.59	.....	2.30	2.10	2.66	3.31	2.85	2.25	1.80	1.98	2.10	2.85
8	1.59	.....	2.56	2.10	3.08	3.34	2.85	2.25	1.80	2.00	2.00	2.80
9	1.59	.....	2.78	2.10	3.05	3.31	2.85	2.25	1.80	2.35	2.00	2.80
10	1.59	1.98	.....	2.10	3.05	3.25	2.82	1.95	1.80	2.45	2.00	2.62
11	1.60	1.98	.....	2.11	3.08	3.29	2.82	1.95	1.80	2.80	2.00	2.15
12	.....	.....	2.80	2.17	3.26	3.24	2.80	1.95	1.80	2.70	2.00	2.10
13	1.90	.....	2.72	2.86	3.39	3.26	2.80	1.95	1.80	3.30	2.00	2.10
14	1.90	.....	2.66	3.20	3.34	3.25	2.80	1.95	1.75	3.05	2.00	2.10
15	1.90	.....	2.60	3.12	3.30	3.18	2.80	1.95	1.75	2.60	2.00	2.10
16	1.90	.....	2.20	2.81	3.30	3.16	2.70	1.95	1.75	2.40	2.00	2.10
17	1.90	2.80	2.22	2.52	3.30	3.16	2.65	1.85	1.75	2.20	2.00	2.10
18	1.90	2.70	2.58	2.52	3.26	3.10	2.55	1.92	1.75	2.15	2.00	2.10
19	1.90	2.40	2.60	2.58	3.18	3.05	2.34	2.00	1.75	2.15	2.00	2.00
20	1.90	2.06	2.70	2.60	3.10	2.90	2.25	1.98	1.75	2.15	2.00	1.95
21	1.90	1.94	2.84	2.60	3.10	2.85	2.25	1.92	1.75	2.15	2.00	1.95
22	1.90	2.48	2.84	2.65	3.25	2.90	2.25	1.90	1.75	2.15	2.00	1.95
23	1.90	2.95	2.84	2.51	3.32	3.00	2.28	1.90	1.75	2.20	2.00	1.90
24	1.89	.....	.....	2.48	3.38	3.10	2.30	1.90	1.75	2.20	2.00	1.90
25	1.70	.....	2.94	2.45	3.42	3.05	2.50	1.85	1.75	2.20	2.00	1.98
26	1.70	.....	2.94	2.42	3.42	3.00	2.50	1.85	1.75	2.20	2.00	2.08
27	1.70	.....	2.48	2.28	3.30	3.00	2.50	1.85	1.75	2.20	2.00	2.10
28	1.69	2.80	2.55	2.14	3.30	3.00	2.50	1.85	1.80	2.20	2.00	2.10
29	1.69	2.75	2.70	2.14	3.29	3.00	2.50	1.80	1.80	2.15	2.00	2.10
30	1.69	.....	2.49	2.12	3.30	3.05	2.38	1.80	1.80	2.15	2.60	2.10
31	1.69	.....	2.14	.....	3.20	.....	2.38	1.80	.....	2.15	.....	2.10

Rating table for Independence Creek below Independence Lake, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	0.5	1.85	2.8	2.40	17	3.00	87
1.55	.7	1.90	3.4	2.50	23	3.10	107
1.60	.9	1.95	4.0	2.60	30	3.20	127
1.65	1.2	2.00	4.7	2.70	40	3.30	148
1.70	1.5	2.10	6.7	2.80	53	3.40	170
1.75	1.9	2.20	9.5	2.90	69	3.50	192
1.80	2.3	2.30	13				

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 2.00 feet and 3.25 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Independence Creek below Independence Lake, Cal., for 1904.

[Drainage area, 8.5 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	3.4	0.6	2.03	125	0.239	0.276
February	78	1.4	26.1	1,501	3.07	3.31
March	76	7.7	35.4	2,177	4.16	4.80
April	127	6.7	24.3	1,446	2.86	3.19
May	174	7.2	110	6,764	12.94	14.92
June	157	61	112	6,664	13.18	14.71
July	107	11	42.5	2,613	5.00	5.76
August	11.0	2.3	5.63	346	.662	.763
September	2.3	1.9	2.11	125	.247	.276
October	148	2.3	18.5	1,138	2.18	2.51
November	30	4.7	6.05	360	.712	.794
December	127	3.4	29.0	1,783	3.41	3.93
The year	174	0.6	34.5	25,040	4.05	55.12

NOTE.—Gage heights interpolated for missing days.

PROSSER CREEK NEAR HOBART MILLS, CAL.

This station was established June 27, 1903, by George B. Lorenz. It is located about 150 feet below the wagon bridge and the road house on the Boca and Truckee highway, 4 miles from Truckee and 3 miles from Hobart Mills. Alder Creek joins Prosser Creek about 200 feet above the station. The nearest dam is located at the ice pond, about 2 miles below the station. The original gage consisted of a 2 by 4 inch vertical timber, graduated to feet and tenths and reading from zero to 4 feet. It was located on the left or north bank, 50 feet upstream from the cable. The old gage rod was washed out by a flood on February 24, 1904. A new gage was established at the same point, with its zero 9.58 feet below bench mark. The zero of the old gage was 9.87 feet below the bench mark. The bench mark is on the northeast pier of the steel wagon bridge, and is the top of the steel casing of the concrete pier above the arrow mark. Readings are taken twice each day by Robert Dorian. Discharge measurements are made from a ⅜-inch steel cable and car stretched across the river about 5 feet above high-water level. A tag wire is stretched just above the cable. The channel is straight for 150 feet above and 200 feet below the cable. The creek makes a bend at the highway bridge. Both banks are high and not subject to overflow. The right bank is wooded; the left is cleared, except for a few willows. The bed is composed of coarse gravel and is free from vegetation. The water flows in one channel at all stages.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Prosser Creek near Hobart Mills, Cal., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Ft. per sec.*	*Feet.*	*Second-feet.*
April 28	W. A. Wolf	60	74	2.93	3.00	217
May 13	do	55	108	5.46	3.95	590
May 26	do	65	99	4.18	3.50	414
June 11	do	65	93	3.72	3.35	346
June 16	A. E. Chandler	60	90	3.70	3.20	334
July 1	W. A. Wolf	60	66	3.05	2.92	201
July 13	do	59	59	2.21	2.70	130
July 23	do	59	55	2.20	2.65	121
August 13	do	54	36	1.10	2.30	40
August 29	do	54	28	.93	2.15	26
November 16	do	15	17	1.78	2.20	31

Mean daily gage height, in feet, of Prosser Creek near Hobart Mills, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.35	2.50	3.05	3.15	3.10	3.45	2.95	2.45	2.15	2.45
2	2.30	2.60	3.20	3.25	3.05	3.45	2.95	2.55	2.15	2.35
3	2.55	2.65	3.25	3.30	3.05	3.50	2.95	2.45	2.15	2.35
4	2.60	2.55	3.15	3.20	3.20	3.45	2.85	2.45	2.15	2.25
5	2.65	2.75	3.05	3.10	3.20	3.40	2.85	2.45	2.15	2.20
6	2.70	2.90	3.15	3.20	3.25	3.45	2.85	2.45	2.15	2.35
7	2.75	2.80	3.45	3.30	3.35	3.45	2.85	2.45	2.15	2.45
8	2.70	2.90	3.65	3.50	3.55	3.35	2.85	2.45	2.15	2.40
9	2.65	2.80	3.45	3.60	3.65	3.25	2.75	2.40	2.15	2.45
10	2.65	2.85	3.65	3.70	3.80	3.25	2.75	2.35	2.15	2.60
11	2.55	2.95	3.45	3.75	3.80	3.25	2.75	2.35	2.15	3.40
12	2.50	3.00	3.15	3.85	3.80	3.25	2.75	2.35	2.15	3.00
13	2.70	3.25	3.10	4.05	3.80	3.20	2.75	2.35	2.10	2.80
14	2.55	3.55	3.05	4.10	3.75	3.25	2.70	2.35	2.10	2.70
15	2.55	4.05	3.00	4.00	3.80	3.25	2.65	2.35	2.10	3.00
16	2.45	4.25	3.00	3.85	3.75	3.25	2.65	2.35	2.15	.....
17	2.55	4.20	3.15	3.70	3.75	3.15	2.60	2.35	2.15	.....
18	2.55	3.85	3.35	3.65	3.75	3.15	2.60	2.25	2.10	.....
19	2.65	3.15	4.25	3.55	3.70	3.05	2.60	2.25	2.10	.....
20	2.70	2.55	4.00	3.55	3.70	3.05	2.60	2.25	2.10	.....
21	2.75	2.90	3.50	3.35	3.70	3.05	2.60	2.25	2.10	.....
22	2.55	3.70	3.25	3.30	3.65	3.05	2.60	2.15	2.20	.....
23	2.60	4.50	3.20	3.10	3.65	3.05	2.60	2.15	2.25	.....
24	2.55	4.70	3.05	3.10	3.65	3.05	2.55	2.20	2.25	.....
25	2.45	4.60	3.00	3.10	3.60	3.05	2.55	2.15	2.20	.....
26	2.55	4.15	3.00	3.05	3.55	3.00	2.55	2.15	2.20	.....
27	2.65	3.95	3.05	3.05	3.55	2.95	2.55	2.15	2.15	.....
28	2.65	3.15	3.30	3.05	3.55	3.00	2.50	2.20	2.15	.....
29	2.55	2.50	3.55	3.05	3.55	3.05	2.50	2.20	2.15	.....
30	2.60	.....	3.25	3.00	3.45	3.05	2.50	2.15	2.20	.....
31	2.70	.....	3.15	.....	3.45	.....	2.45	2.15	.....	.....

NOTE.—Gage heights for entire year refer to new datum.

Rating table for Prosser Creek near Hobart Mills, Cal., from June 27, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.10	23	2.90	190	3.70	490	4.50	836
2.20	30	3.00	221	3.80	532	4.60	880
2.30	42	3.10	256	3.90	574	4.70	924
2.40	59	3.20	293	4.00	616	4.80	968
2.50	80	3.30	331	4.10	660	4.90	1,012
2.60	103	3.40	370	4.20	704	5.00	1,056
2.70	130	3.50	410	4.30	748	5.10	1,100
2.80	160	3.60	450	4.40	792		

The above table is applicable only for open-channel conditions. It is based upon 15 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.80 feet and 3.50 feet. The table has been extended beyond these limits. Above gage height 4.00 feet the rating curve is a tangent, the difference being 44 per tenth.

Estimated monthly discharge of Prosser Creek near Hobart Mills, Cal., for 1903 and 1904.

[Drainage area, 48 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
July	69	18	31.3	1,925	0.652	0.752
August	20	12	16.8	1,033	.350	.404
September	12	10	10.5	625	.219	.244
October, 10 days	184	17	12.0	238	.250	.093
November, 19 days	370	30	16.3	6,142	3.40	2.40
December	130	42	75.0	4,612	1.56	1.80
The period				14,580		
1904.						
January	145	42	102	6,272	2.12	2.44
February	924	80	363	20,880	7.56	8.15
March	726	221	329	20,230	6.85	7.90
April	660	221	380	22,610	7.75	8.84
May	532	238	433	26,620	9.02	10.40
June	410	205	296	17,610	6.17	6.88
July	205	69	128	7,870	2.67	3.08
August	97	26	45.8	2,816	.954	1.10
September	35	23	6.4	1,571	.550	.614
October 1–15	370	30	112	3,332	2.33	1.30
The period				129,800		

DONNER CREEK NEAR TRUCKEE, CAL.

This station was established October 23, 1902, by E. C. Murphy. It is located about 150 feet below the dam of the Donner Creek Ice Company and 1½ miles west of Truckee, Cal. The gage is a 4 by 4 inch vertical timber located on the left bank. It is read twice each day by F. R. Williams. Discharge measurements are made by means of a cable and car 50 feet downstream from the gage. The channel is straight for 150 feet above and below the cable. Both banks are high and will not overflow. The bed of the stream is composed of gravel, permanent and free from vegetation. There is but one channel at all stages and the current is swift. The bench mark consists of four nails driven into the root of a pine tree 12 inches in diameter and 35 feet north of the gage. Its elevation is 6.30 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Donner Creek near Truckee, Cal., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 13	W. A. Wolf	40	114	4.90	4.60	559
May 26	do	40	108	4.97	4.55	536
June 11	do	40	77	4.35	3.80	334
June 17	A. E. Chandler	36	64	4.12	3.53	264
July 13	W. A. Wolf	18	20	2.31	2.25	46
July 23	do	18	19	2.29	2.20	43
August 13	do	14	11	1.04	1.55	11
August 29	do	8	4	1.05	1.35	4
November 16	do	14	11	1.07	1.60	12

Mean daily gage height, in feet, of Donner Creek near Truckee, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.60	2.00	3.30	3.65	3.35	4.20	3.15	1.80	1.35	2.25	1.90	1.70
2	1.60	2.00	3.85	3.60	3.30	4.40	3.05	1.70	1.35	2.00	1.90	1.70
3	1.80	2.00	4.30	3.60	3.35	4.35	2.85	1.70	1.30	1.85	1.90	1.70
4	2.05	2.00	4.80	3.50	3.40	4.35	2.75	1.70	1.30	1.80	1.90	1.70
5	1.85	1.90	4.35	3.50	3.55	4.25	2.70	1.70	1.30	1.80	1.60	1.40
6	2.00	1.90	4.10	3.50	3.75	4.30	2.70	1.70	1.30	1.85	1.35	1.40
7	2.00	1.90	4.20	3.50	3.95	4.30	2.70	1.70	1.30	2.05	1.40	1.40
8	2.00	2.00	4.40	3.55	4.15	4.25	2.55	1.60	1.30	2.05	1.60	1.40
9	2.00	2.00	4.05	3.60	4.30	4.15	2.45	1.60	1.30	2.05	1.80	1.45
10	2.00	2.00	4.00	3.60	4.40	3.90	2.40	1.55	1.30	2.60	1.80	1.50
11	2.00	2.00	3.85	3.80	4.35	3.90	2.45	1.55	1.30	3.25	1.80	1.40
12	2.00	2.00	3.75	4.00	4.50	3.75	2.30	1.55	1.30	2.85	1.80	1.40
13	2.00	2.00	3.65	4.25	4.60	3.70	2.20	1.50	1.55	2.60	1.80	1.40
14	2.00	2.00	3.60	4.25	4.65	3.70	2.10	1.50	2.60	2.55	1.80	1.40
15	2.00	2.15	3.50	4.25	4.65	3.70	2.10	1.45	2.55	2.50	1.80	1.40
16	2.05	2.80	3.50	4.05	4.75	3.60	1.70	1.45	2.50	2.45	1.60	1.40
17	2.00	2.75	3.45	3.95	4.75	3.50	1.60	1.45	2.40	2.40	1.60	1.40
18	2.00	2.50	4.10	4.00	4.55	3.50	2.15	1.50	2.30	2.30	1.45	1.40
19	2.50	2.50	4.45	4.00	4.35	3.50	2.25	1.50	2.25	2.30	1.25	1.40
20	2.50	2.40	4.05	3.90	4.30	3.55	2.20	1.45	2.20	2.30	1.20	1.40
21	2.00	2.55	4.05	3.80	4.65	3.55	2.10	1.40	2.15	2.20	1.20	1.40
22	2.00	4.30	4.60	3.65	5.10	3.60	2.10	1.40	2.10	2.20	1.20	1.40
23	2.00	4.90	4.45	3.60	5.10	3.50	2.10	1.40	2.10	2.20	1.20	1.40
24	2.00	5.05	4.20	3.50	4.70	3.35	2.10	1.40	2.30	2.10	1.20	1.40
25	2.00	3.95	4.05	3.50	4.75	3.30	2.10	1.45	2.30	2.10	1.20	1.70
26	2.00	3.70	3.90	3.45	4.55	3.30	2.10	1.45	2.30	2.00	1.65	1.64
27	2.00	3.60	3.90	3.40	4.50	3.30	2.00	1.45	2.35	2.00	1.70	1.40
28	2.00	3.50	4.20	3.40	4.60	3.30	1.95	1.40	2.05	2.00	1.70	1.40
29	2.00	3.40	4.05	3.40	4.55	3.30	1.90	1.40	2.00	2.00	1.70	1.30
30	2.00	.....	3.90	3.40	4.50	3.20	1.90	1.40	2.00	2.00	1.70	1.80
31	2.00	.....	3.80	.....	4.35	.....	1.90	1.35	.....	1.95	.....	[illegible]

NOTE.—The creek does not freeze over owing to the swift current.

Rating table for Donner Creek near Truckee, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.40	5.5	1.95	25	3.00	156	4.10	411
1.45	6.5	2.00	28	3.10	176	4.20	438
1.50	8	2.10	35	3.20	196	4.30	466
1.55	9.5	2.20	43	3.30	216	4.40	494
1.60	11	2.30	52	3.40	238	4.50	523
1.65	12.5	2.40	63	3.50	260	4.60	553
1.70	14	2.50	76	3.60	284	4.70	583
1.75	16	2.60	90	3.70	308	4.80	613
1.80	18	2.70	105	3.80	333	4.90	645
1.85	20	2.80	121	3.90	359	5.00	677
1.90	22	2.90	138	4.00	385	5.10	709

The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements made during 1904. It is well defined between gage heights 1.35 feet and 4.60 feet. The table has been extended above 4.60 feet.

Estimated monthly discharge of Donner Creek near Truckee, Cal., for 1904.

[Drainage area, 30 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	76	11	29.6	1,820	0.987	1.14
February	693	22	145	8,341	4.83	5.21
March	613	216	391	24,040	13.03	15.02
April	452	238	312	18,560	10.40	11.60
May	709	216	482	29,640	16.07	18.53
June	494	196	326	19,400	10.87	12.13
July	186	11	59.4	3,652	1.98	2.28
August	18	4.5	11.4	701	.380	.438
September	90	3.5	30.6	1,821	1.02	1.14
October	206	18	50.6	3,111	1.69	1.95
November	22	2.5	12.0	714	.400	.446
December	57	3.5	9.2	566	.307	.354
The year	709	2.5	155	112,400	5.16	70.24

WALKER RIVER (WEST FORK) NEAR COLEVILLE, CAL.

This station was established October 5, 1902, by E. C. Murphy. The gage is a 4 by 4 inch vertical timber on the left bank, about one-half mile above the cable and 300 feet from the observer's house. It is read once each day by J. S. Trumble. Discharge measurements are made by means of a cable and car near the mouth of the canyon about 1 mile east of the point where the main road from Topaz to Bridgeport crosses Lost Canyon Creek. The cable is located about 600 feet from the road. The initial point for soundings is the zero on the tagged wire. The channel is straight for 150 feet above and below the station. The current is swift. The right bank is low and rocky and is liable to overflow; the left bank is high and rocky and will not overflow. The bed of the stream is rocky and uneven. There is but one channel at all stages. The bench mark is a spike driven into the tree to which the gage is fastened. Its elevation is 6.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Walker River (West Fork) near Coleville, Cal., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
March 23	L. A. Wolley		107	1.52	1.80	163
May 4	R. A. Craig	42	102	3.38	2.32	345
July 5	J. T. Shaw	54	172	5.94	3.82	1,022
July 13	do	52	153	4.61	3.29	705
July 20	do	53	177	4.78	3.38	847
July 27	do	52	160	4.42	3.18	707
August 3	do	51	138	3.81	2.79	526
August 10	do	51	133	3.45	2.62	459
August 17	do		137	3.50	2.62	480
August 24	do		112	2.38	2.21	267
September 8	do		105	1.38	1.65	145
October 17	do		120	1.98	2.05	237

Mean daily gage height, in feet, of Walker River (West Fork) near Coleville, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.10	1.00	1.70	2.00	2.00	3.70	3.70	2.70	1.90	2.80	1.80	1.40
2	1.10	1.00	1.70	2.00	2.10	3.40	3.70	2.50	1.80	2.80	1.70	1.40
3	1.10	1.00	1.70	2.00	2.20	3.70	3.50	2.50	1.80	2.80	1.70	1.30
4	1.10	1.00	1.70	1.90	2.20	4.00	3.50	2.50	1.80	2.80	1.70	1.30
5	1.10	1.00	1.70	1.80	2.30	4.00	3.50	2.60	1.80	2.80	1.70	1.30
6	1.10	1.00	1.70	1.90	2.50	4.30	3.50	2.70	1.80	2.70	1.70	1.30
7	1.10	1.00	1.80	2.00	3.00	4.20	3.60	2.60	1.80	2.80	1.60	1.20
8	1.10	1.00	2.00	2.60	3.30	4.00	3.50	2.50	1.70	2.70	1.60	1.20
9	1.10	1.00	2.00	2.60	3.40	3.90	3.60	2.50	1.70	1.60	1.60	1.30
10	1.10	1.00	1.80	2.70	3.50	3.80	3.70	2.50	1.70	2.00	1.60	1.40
11	1.10	1.10	1.90	2.80	3.50	3.90	3.70	2.50	1.70	2.60	1.60	1.60
12	1.10	1.20	1.80	3.10	3.50	4.10	3.70	2.40	1.60	2.30	1.60	1.40
13	1.00	1.20	1.90	3.10	3.90	4.10	3.40	2.50	1.50	2.50	1.50	1.40
14	1.00	1.20	1.70	3.00	3.60	4.00	3.10	2.60	1.70	2.30	1.50	1.40
15	1.00	1.30	1.80	3.00	3.70	4.20	3.10	2.60	1.80	2.20	1.50	1.40
16	1.00	1.70	1.80	2.70	3.70	4.10	3.10	2.60	1.80	2.10	1.54	1.40
17	1.00	1.30	1.70	2.60	3.60	4.00	3.10	2.40	1.80	2.00	1.50	1.30
18	1.00	1.30	1.80	2.70	3.60	4.00	3.10	2.20	1.80	2.00	1.50	1.30
19	1.00	1.30	2.00	2.70	3.90	4.10	3.10	2.20	1.70	2.00	1.50	1.20
20	1.00	1.30	2.10	2.60	3.70	4.10	3.10	2.20	1.70	2.00	1.50	1.20
21	1.00	1.50	2.10	2.50	3.60	4.10	3.30	2.10	1.70	2.00	1.50	1.30
22	1.00	2.00	1.90	2.50	3.70	4.00	3.50	2.00	1.60	2.00	1.50	1.30
23	1.00	2.70	1.80	2.50	4.00	3.90	3.40	2.00	1.70	1.90	1.50	1.20
24	1.00	2.70	1.70	2.60	4.10	3.80	3.40	2.10	1.80	1.90	1.50	1.10
25	1.00	2.40	1.80	2.70	4.90	3.70	3.30	2.20	2.00	1.90	1.50	1.10
26	1.00	2.00	1.80	2.60	3.80	3.70	3.20	2.10	1.90	1.90	1.50	1.10
27	1.00	1.80	1.90	2.20	3.70	3.70	3.20	2.10	1.90	1.80	1.50	1.10
28	1.00	1.80	2.00	2.20	3.80	3.80	3.00	2.10	1.90	1.80	1.50	1.10
29	1.00	1.80	2.30	2.10	3.90	3.80	2.90	2.10	2.00	1.80	1.50	1.30
30	1.00	.....	2.10	2.00	4.00	3.70	2.70	2.00	2.40	1.80	1.50	1.40
31	1.00	.....	2.00	.....	4.00	.....	2.60	1.90	.....	1.80	.....	1.30

Rating table for Walker River (West Fork) near Coleville, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	60	2.00	220	3.00	605	4.00	1,240
1.10	67	2.10	248	3.10	655	4.10	1,320
1.20	75	2.20	278	3.20	708	4.20	1,405
1.30	85	2.30	311	3.30	764	4.30	1,495
1.40	98	2.40	347	3.40	823	4.40	1,585
1.50	113	2.50	385	3.50	885	4.50	1,680
1.60	130	2.60	425	3.60	950	4.60	1,780
1.70	149	2.70	467	3.70	1,015	4.70	1,885
1.80	170	2.80	511	3.80	1,085	4.80	1,990
1.90	194	2.90	557	3.90	1,160	4.90	2,100

The above table is applicable only for open-channel conditions. It is based upon 13 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.00 foot and 3.70 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Walker River (West Fork) near Coleville, Cal., for 1904.

[Drainage area, 306 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	67	60	62.7	3,855	0.205	0.236
February	467	60	131	7,535	.428	.461
March	311	149	187	11,500	.611	.704
April	655	170	384	22,850	1.25	1.40
May	2,100	220	919	56,510	3.00	3.46
June	1,495	823	1,188	70,690	3.88	4.33
July	1,015	425	785	48,270	2.57	2.96
August	467	194	332	20,410	1.08	1.24
September	347	113	172	10,240	.562	.627
October	511	130	299	18,380	.977	1.13
November	170	113	125	7,438	.408	.455
December	130	67	85.7	5,269	.280	.323
The year	2,100	60	389	282,900	1.27	17.33

WALKER RIVER (EAST FORK) NEAR YERINGTON, NEV.

This station was established October 6, 1902, by E. C. Murphy. It is located at Ross ranch, about 10 miles southeast of Yerington, Nev. The station is just above the point where the road crosses the river. The gage is a vertical 4 by 4 inch timber fastened to the right bank just below the cable. It is read once each day by I. A. Strosnider, the ranch owner. Discharge measurements are made by means of a cable and car. The initial point for soundings is the zero of the tagged wire. The channel is straight for 200 feet above and for 100 feet below the station. At low water the sand bar in the middle of the stream divides the channel into two parts. Both banks are low and are liable to overflow. The bed of the stream is composed of sand and clay and is liable to shift. The current has a moderate velocity. The bench mark consists of three nails and a spike in a stump 6 inches in diameter and 15 feet east of the gage. Its elevation is 5.85 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Walker River (East Fork) near Yerington, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 5	R. A. Craig	42	32	2.00	1.52	64
May 10	do	39	34	2.12	1.65	72
July 7	J. T. Shaw	75	163	2.94	3.31	479
July 12	do	75	153	2.85	3.02	436
July 21	do	76	134	2.90	2.98	389
July 26	do	76	148	3.09	3.25	458
August 4	do	76	140	2.94	3.08	412
August 9	do	76	130	2.72	2.90	353
August 18	do	.....	144	2.94	3.08	423
August 23	do	.....	108	2.77	2.60	298
September 12	do	.....	53	2.22	1.95	118
October 23	do	.....	97	2.64	2.52	255

Mean daily gage height, in feet, of Walker River (East Fork) near Yerington, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.60	1.50	2.50	2.20	1.60	3.00	3.60	3.10	2.30	[a]2.85	2.70	2.20
2	1.60	1.50	2.50	2.15	1.50	3.00	3.50	3.10	2.20	2.80	2.70	2.20
3	1.60	1.60	2.50	2.10	1.50	3.05	3.50	3.00	2.20	2.80	2.70	2.20
4	1.50	1.70	2.50	2.00	1.50	3.05	3.50	3.00	2.20	2.80	2.70	2.20
5	1.50	1.70	2.40	1.90	1.50	3.20	3.40	3.00	2.20	2.80	2.70	2.20
6	1.50	1.70	2.30	1.90	1.50	3.30	3.40	3.00	2.20	2.70	2.70	2.20
7	1.50	1.70	2.30	1.90	1.60	3.40	3.40	2.90	2.10	2.70	2.60	2.10
8	1.50	1.70	2.30	2.00	1.60	3.50	3.30	2.90	2.10	2.70	2.60	2.10
9	1.50	1.60	2.30	2.05	1.70	3.55	3.30	2.90	2.10	2.70	2.60	2.10
10	1.60	1.60	2.30	2.10	1.70	3.60	3.20	2.90	2.10	2.70	2.60	2.10
11	1.75	1.60	2.30	2.10	1.70	3.60	3.20	2.80	2.00	2.70	2.50	2.00
12	1.70	1.65	2.30	2.20	1.80	3.60	3.10	2.80	2.00	2.70	2.50	2.00
13	1.60	1.75	2.30	2.30	1.90	3.60	3.00	2.80	2.00	2.70	2.50	2.00
14	1.60	1.90	2.30	2.30	2.00	3.60	2.90	2.85	2.00	2.60	2.50	2.00
15	1.60	2.05	2.30	2.25	2.05	3.70	2.90	2.90	2.00	2.60	2.40	2.00
16	1.60	2.45	2.45	2.20	2.35	3.70	2.80	2.90	2.00	2.60	2.40	2.00
17	1.65	2.80	2.40	2.20	2.40	3.70	2.90	3.75	2.00	2.60	2.40	2.00
18	1.65	2.65	2.40	2.15	2.50	3.70	2.90	3.20	2.00	2.60	2.40	2.00
19	1.70	2.25	2.40	2.10	2.60	3.80	2.90	3.10	2.00	2.60	2.30	2.00
20	1.70	2.00	2.50	2.05	2.60	3.80	2.90	3.00	2.00	2.60	2.30	2.00
21	1.60	2.00	2.50	2.00	2.70	3.80	2.90	2.90	2.00	2.65	2.20	2.00
22	1.50	2.05	2.40	2.00	2.70	3.90	3.90	2.75	2.00	2.70	2.20	2.00
23	1.50	2.25	2.40	1.90	2.80	3.90	3.50	2.65	2.00	2.70	2.20	2.00
24	1.50	2.50	2.40	1.90	2.85	3.80	3.20	2.60	2.00	2.70	2.20	2.00
25	1.50	3.05	2.30	1.80	2.90	3.80	3.10	3.15	2.30	2.70	2.20	2.00
26	1.50	3.00	2.30	1.80	3.30	3.70	3.10	2.90	2.95	2.80	2.20	2.00
27	1.50	2.75	2.30	1.80	3.20	3.70	3.20	2.40	3.00	2.80	2.20	2.00
28	1.50	2.55	2.50	1.80	3.10	3.60	3.20	2.30	3.00	2.80	2.20	2.00
29	1.50	2.50	2.60	1.70	3.00	3.65	3.20	2.30	2.90	2.80	2.20	2.20
30	1.50	.....	2.40	1.70	2.95	3.60	3.10	2.30	2.90	2.80	2.20	2.20
31	1.50	.....	2.40	.....	2.90	.....	3.10	2.30	.....	2.80	.....	2.10

[a] Interpolated.

Rating table for Walker River (East Fork) near Yerington, Nev., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	60	2.20	172	2.90	358	3.50	560
1.60	73	2.30	193	3.00	390	3.60	594
1.70	87	2.40	216	3.10	424	3.70	628
1.80	102	2.50	241	3.20	458	3.80	662
1.90	118	2.60	268	3.30	492	3.90	696
2.00	135	2.70	297	3.40	526	4.00	730
2.10	153	2.80	327				

The above table is applicable only for open-channel conditions. It is based upon 20 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.50 feet and 3.30 feet. The table has been extended above gage height 3.30 feet. Above gage height 3.00 feet the rating curve is a tangent, the difference being 34 per tenth.

Estimated monthly discharge of Walker River (East Fork) near Yerington, Nev., for 1904.

[Drainage area, 1,103 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	95	60	68.8	4,230	0.062	0.072
February	407	60	164	9,433	.149	.161
March	268	193	214	13,160	.194	.224
April	193	87	140	8,331	.127	.142
May	492	60	213	13,100	.193	.222
June	696	390	582	34,630	.528	.589
July	696	327	458	28,160	.415	.478
August	645	193	349	21,460	.316	.364
September	390	135	187	11,130	.170	.190
October	343	268	301	18,510	.273	.315
November	297	172	226	13,450	.205	.229
December	172	135	147	9,039	.133	.153
The year	696	60	254	184,600	.230	3.14

WALKER RIVER NEAR WABUSKA, NEV.

This station was established July 22, 1902, by L. H. Taylor. It was equipped December 12, 1902, by E. C. Murphy. It is located about 300 feet above the Carson and Colorado Railroad bridge near the section house at Clever station. It is about 2½ miles east of Wabuska. The original gage was washed out December 30, 1903. A new gage, consisting of a 1 by 4 inch board fastened to a vertical 4 by 4 inch timber, was installed January 17, 1904. It is on the left bank 15 feet below the point at which the old gage was located and 150 feet south of the section house. The datum is the same as that of the original gage. The gage is read twice each day by Charles Nelson. Discharge measurements are made by means of a cable and car 35 feet below the gage. The initial point for soundings is the zero on the tagged wire. The channel is straight for 150 feet above the station and slightly curved for the same distance below. Both banks are high and not liable to overflow. The bed of the stream is sandy and shifting. There is but one channel at all stages. The current has a moderate velocity and the discharge is small from August to October. The bench mark consists of four nails driven into the northwest corner of the pump platform 35 feet east of the gage. Its elevation is 6.94 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Walker River near Wabuska, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 25	L. A. Wooley	71	110	2.16	2.15	238
April 29	R. A. Craig	46	60	2.17	1.76	130
May 6	do	58	45	1.69	1.58	76
May 9	do	65	86	2.41	2.10	207
July 8	J. T. Shaw	74	303	3.22	3.72	976
July 11	do	74	299	3.19	3.58	955
July 22	do	68	170	2.96	2.60	503
July 25	do	75	260	3.33	3.40	866
August 5	do	74	165	2.93	2.45	483
August 8	do	65	150	2.74	2.30	411
August 19	do		144	2.59	2.30	373
August 22	do		117	2.28	1.94	267
September 13	do		28	1.61	1.03	45
October 24	do		164	2.67	2.41	438

Mean daily gage height, in feet, of Walker River near Wabuska, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.30	2.60	2.25	1.70	4.10	4.00	2.43	1.72	2.00	2.48	2.00
2	.....	2.15	2.35	2.20	1.65	3.95	4.00	2.48	1.68	2.10	2.45	2.00
3	2.00	2.00	2.35	2.18	1.65	3.90	3.92	2.52	1.60	2.30	2.40	2.00
4	2.05	2.00	2.40	2.12	1.60	3.95	3.85	2.55	1.52	2.30	2.40	2.00
5	2.50	1.90	2.30	2.10	1.60	4.20	3.72	2.42	1.50	2.50	2.38	1.95
6	2.95	1.85	2.30	2.02	1.60	4.20	3.62	2.40	1.45	2.50	2.30	1.95
7	3.25	1.80	2.25	2.05	1.62	4.35	3.70	2.40	1.40	2.50	2.30	1.90
8	3.05	1.75	2.15	2.10	1.75	4.45	3.72	2.35	1.40	2.45	2.30	1.90
9	2.85	1.80	2.20	2.10	2.02	4.60	3.75	2.30	1.35	2.40	2.25	1.90
10	2.70	1.75	2.20	2.10	2.25	4.45	3.70	2.22	1.30	2.35	2.25	1.90
11	2.60	1.80	2.20	2.18	2.40	4.30	3.62	2.18	1.30	2.45	2.25	1.85
12	2.50	1.85	2.20	2.25	2.55	4.35	3.45	2.12	1.20	2.65	2.20	1.85
13	2.40	1.80	2.10	2.38	2.75	4.35	3.40	2.02	1.05	2.90	2.17	1.85
14	2.50	1.75	2.12	2.35	2.92	4.32	3.20	2.00	1.00	2.95	2.12	1.80
15	2.50	1.72	2.20	2.35	3.10	4.32	3.05	2.00	1.00	2.90	2.10	1.80
16	2.40	1.90	2.28	2.50	3.20	4.35	2.90	2.02	1.00	2.80	2.02	1.82
17	3.20	2.05	2.30	2.62	3.28	4.42	2.75	2.38	1.00	2.70	2.00	1.85
18	2.80	2.50	2.30	2.50	3.35	4.40	2.68	2.42	1.00	2.60	2.00	1.85
19	2.70	2.38	2.30	2.38	3.48	4.40	2.60	2.28	1.00	2.50	1.95	1.85
20	2.65	2.30	2.30	2.30	3.55	4.45	2.60	2.18	1.00	2.50	1.95	1.85
21	2.60	2.25	2.40	2.22	3.38	4.40	2.58	2.00	1.00	2.50	1.97	1.80
22	2.50	2.25	2.40	2.20	3.22	4.32	2.55	1.98	1.00	2.45	2.00	1.80
23	2.45	2.20	2.35	2.15	3.40	4.30	2.55	1.95	1.00	2.45	2.00	1.80
24	2.40	2.25	2.30	2.05	3.75	4.28	3.20	1.85	1.00	2.42	2.00	1.80
25	2.40	2.80	2.20	2.00	4.20	4.22	3.40	1.78	1.10	2.40	2.00	1.80
26	2.45	3.30	2.20	1.95	4.55	4.12	3.32	1.78	1.55	2.40	2.00	1.75
27	2.40	3.15	2.20	1.90	4.88	4.05	3.28	1.95	2.00	2.40	2.00	1.80
28	2.45	2.80	2.35	1.85	4.60	3.98	3.18	2.08	2.05	2.40	2.00	1.82
29	2.40	2.70	2.42	1.80	4.25	3.92	3.02	2.08	2.00	2.40	2.00	1.85
30	2.25	.....	2.55	1.75	4.00	3.98	2.98	1.95	1.95	2.45	2.00	1.80
31	2.25	.....	2.45	.....	4.05	.....	2.80	1.82	.....	2.50	.....	2.02

Rating table for Walker River near Wabuska, Nev., from January 1 to May 29, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	64	2.40	315	3.30	732	4.20	1,182
1.60	83	2.50	354	3.40	782	4.30	1,232
1.70	105	2.60	395	3.50	832	4.40	1,282
1.80	129	2.70	438	3.60	882	4.50	1,332
1.90	155	2.80	483	3.70	932	4.60	1,382
2.00	183	2.90	532	3.80	982	4.70	1,432
2.10	213	3.00	582	3.90	1,032	4.80	1,482
2.20	245	3.10	632	4.00	1,082	4.90	1,532
2.30	279	3.20	682	4.10	1,132		

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during the spring of 1904. It is well defined between gage heights 1.60 feet and 2.15 feet. The table has been extended beyond these limits, but is poorly defined. Above gage height 2.85 feet the rating curve is a tangent, the difference being 50 per tenth.

Rating table for Walker River near Wabuska, Nev., from May 30 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	40	2.00	285	3.00	678	3.90	1,081
1.10	55	2.10	321	3.10	720	4.00	1,127
1.20	73	2.20	359	3.20	763	4.10	1,173
1.30	93	2.30	397	3.30	807	4.20	1,219
1.40	115	2.40	435	3.40	851	4.30	1,265
1.50	139	2.50	475	3.50	897	4.40	1,311
1.60	164	2.60	515	3.60	943	4.50	1,357
1.70	191	2.70	555	3.70	989	4.60	1,403
1.80	220	2.80	595	3.80	1,035	4.70	1,449
1.90	251	2.90	636				

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during latter half of 1904. It is fairly well defined between gage heights 2.30 feet and 3.70 feet. The table has been extended beyond these limits, but is poorly defined. Above gage height 3.40 feet the rating curve is a tangent, the difference being 46 per tenth.

Estimated monthly discharge of Walker River near Wabuska, Nev., for 1904.

[Drainage area, 2,420 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	707	108	369	22,690	0.152	0.175
February	732	110	255	14,670	.105	.113
March	395	213	280	17,220	.116	.134
April	403	117	237	14,100	.098	.109
May	1,522	83	629	38,680	.260	.300
June	1,403	1,081	1,240	73,790	.512	.571
July	1,127	495	797	49,010	.329	.379
August	495	214	346	21,280	.143	.165
September	303	40	114	6,783	.047	.052
October	657	285	471	28,960	.195	.225
November	467	268	338	20,110	.140	.156
December	292	205	242	14,880	.100	.115
The year	1,522	40	443	322,200	.183	2.49

CARSON RIVER (WEST FORK) NEAR WOODFORDS, CAL.

This station was established October 18, 1900, by L. H. Taylor. It is located about three-fourths mile above the post-office at Woodfords and 200 feet from the main road between Woodfords and Blue Lakes, Cal. The gage is a vertical board nailed to a cottonwood tree on the left bank. It is read once each day by Miss Bernice Merrill. Discharge measurements are made by means of a cable and car just below the gage. The initial point for soundings is the zero of the tagged wire. The channel is straight for 100 feet above and below the cable, and there is but one channel at all stages. Both banks are high and rocky and are not liable to overflow. The bed of the stream is rocky and uneven and is not liable to change. At high water the current velocity is too high for accurate measurement.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Carson River (West Fork) near Woodfords, Cal., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
May 3	R. A. Craig	22	66	3.08	3.75	203
July 3	J. T. Shaw	29	92	2.71	3.95	249
July 15	do	28	76	2.29	3.61	174
July 18	do	28	72	2.18	3.55	157
July 29	do	22	49	2.18	3.20	107
August 1	do	22	46	2.15	3.12	99
August 12	do		40	2.08	2.83	83
August 15	do		37	1.89	2.68	70
September 6	do		34	1.88	2.55	64
September 23	do		35	1.40	2.52	49
October 13	do	30	56	1.90	3.15	106

Mean daily gage height, in feet, of Carson River (West Fork) near Woodfords, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.43	.....	3.82	3.60	3.71	4.84	3.82	3.09	2.55	2.88	2.68	2.58
2	2.43	.....	3.66	3.50	3.66	4.95	3.80	3.14	2.55	2.73	2.68	2.58
3	2.43	.....	3.60	3.55	4.12	4.95	3.77	3.09	2.55	2.73	2.68	2.58
4	2.38	.....	3.60	3.50	4.43	5.20	3.77	3.09	2.60	2.68	2.68	2.58
5	2.38	.....	3.66	3.45	4.90	5.20	3.82	2.99	2.55	2.78	2.63	2.53
6	2.38	.....	3.71	3.55	5.52	5.09	3.77	3.04	2.50	2.88	2.58	2.58
7	2.48	2.48	3.71	3.66	5.78	5.04	3.72	2.88	2.55	2.88	2.58	2.53
8	2.48	2.53	3.71	3.87	5.78	4.88	3.67	2.88	2.44	2.83	2.58	2.53
9	2.58	2.53	3.66	4.12	5.98	4.78	3.67	2.88	2.39	2.88	2.58	2.58
10	2.58	2.48	3.60	4.38	6.14	4.68	3.67	2.78	2.39	3.04	2.63	2.58
11	2.58	2.48	3.50	4.68	6.40	4.68	3.62	2.78	2.39	3.09	2.63	2.58
12	2.58	2.53	3.45	4.95	6.45	4.73	3.57	2.83	2.44	2.99	2.68	2.58
13	2.58	2.58	3.40	5.68	6.19	4.78	3.62	2.78	2.34	2.88	2.68	2.48
14	2.58	2.63	3.45	5.37	6.19	4.88	3.65	2.73	2.78	2.83	2.68	2.53
15	2.63	2.68	3.45	5.10	6.14	4.83	3.67	2.68	2.99	2.88	2.68	2.53
16	2.58	2.78	3.35	4.95	5.98	4.73	3.62	2.68	3.09	2.88	2.63	2.38
17	2.53	2.83	3.30	4.95	5.98	4.68	3.57	2.63	2.88	2.78	2.58	2.53
18	2.53	2.83	3.30	4.90	5.52	4.68	3.57	2.68	3.76	2.88	2.68	2.58
19	2.53	2.88	3.87	4.84	5.57	4.68	3.52	2.63	2.68	2.88	2.63	2.63
20	2.53	2.99	3.76	4.79	5.73	4.58	3.47	2.58	2.63	2.88	2.63	2.58
21	2.53	3.14	3.71	4.79	5.73	4.47	3.57	2.48	2.63	2.88	2.58	2.58
22	2.53	3.66	3.60	4.22	5.47	4.37	3.57	2.48	2.58	2.83	2.63	2.58
23	2.53	3.92	3.60	4.22	5.57	4.22	3.24	2.53	2.53	2.78	2.68	2.68
24	2.48	4.43	3.55	4.27	5.47	4.17	3.24	2.63	2.68	2.78	2.63	2.63
25	2.48	4.48	3.50	4.38	5.47	4.07	3.24	2.58	2.68	2.73	2.78	2.68
26	2.43	4.32	3.55	4.07	5.21	4.02	3.09	2.48	2.68	2.68	2.78	2.68
27	2.43	4.27	3.66	2.88	4.84	4.02	3.19	2.[illegible]5	2.68	2.68	2.68	2.73
28	2.43	4.02	3.87	3.71	4.84	4.02	3.14	2.70	2.63	2.68	2.68	2.83
29	2.38	3.97	3.76	3.82	4.84	3.97	3.14	2.70	2.68	2.63	2.63	3.09
30	2.38	.....	3.71	3.76	4.79	4.07	3.09	2.65	2.73	2.63	2.63	3.24
31	.....	.....	3.66	.....	4.84	.....	3.09	2.60	.....	2.63	.....	2.99

Rating table for Carson River (West Fork) near Woodfords, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.20	36	3.30	128	4.40	304	5.50	657
2.30	42	3.40	140	4.50	327	5.60	697
2.40	48	3.50	154	4.60	352	5.70	737
2.50	54	3.60	168	4.70	379	5.80	779
2.60	61	3.70	182	4.80	408	5.90	823
2.70	69	3.80	197	4.90	439	6.00	869
2.80	77	3.90	213	5.00	472	6.10	916
2.90	86	4.00	229	5.10	507	6.20	964
3.00	96	4.10	246	5.20	543	6.30	1,012
3.10	106	4.20	264	5.30	580	6.40	1,060
3.20	116	4.30	283	5.40	618	6.50	1,110

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1902 to 1904, inclusive. It is poorly defined. The table has been extended above gage height 4.50 feet.

Estimated monthly discharge of Carson River (West Fork) near Woodfords, Cal., for 1904.

[Drainage area, 70 square miles.]

Month.	Discharge in second-feet.			Total in acre feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January 1–30	63	47	53.8	3,201	0.769	0.858
February 7–29	322	53	134	6,113	1.91	1.63
March	208	128	169	10,390	2.41	2.78
April	729	84	305	18,150	4.36	4.86
May	1,085	176	651	40,030	9.30	10.72
June	543	224	368	21,900	5.26	5.87
July	200	105	158	9,715	2.26	2.61
August	110	53	74.4	4,575	1.06	1.22
September	191	44	67.1	3,993	.959	1.07
October	105	63	78.4	4,821	1.12	1.29
November	75	59	64.6	3,844	.923	1.03
December	121	47	64.5	3,966	.921	1.06
The period				130,700		

CARSON RIVER (EAST FORK) NEAR GARDNERVILLE, NEV.

The gaging station was established by L. H. Taylor on October 17, 1900, at the place where measurements were made in the years 1890, 1891, and 1892. The old gage was an inclined timber securely fastened to posts set in the right bank of the stream. The old bench mark was on a basalt rock in the edge of the stream, 20 feet from the gage and at an elevation of 6.30 feet above gage datum.

On August 2, 1901, a loose-rock dam was raised a short distance below the gaging station, which affected the velocity at the latter point. The dam was partly washed out by a freshet on December 4, 1901. A new gage was established on March 10, 1902, a short distance downstream from the original one, which had been destroyed. It consists of a vertical timber driven into the stream bed at the right bank and spiked to a cottonwood tree. On October 3, 1902, a new inclined gage was installed by E. C. Murphy at a point on the left bank of the river 600 feet above the cable. During 1904 gage heights were read on the vertical gage at the cable.

The gage is read twice each day by Miss Susie Rodenbah. Discharge measurements are made by means of a cable and car located at the vertical gage about 400 feet above the bridge. The initial point for soundings is the zero of the tagged wire on the right bank. The

channel is straight for 300 feet above and below the station. It is broad and shallow. There is but one channel at all stages, and the current is moderate. Both banks are high and are not liable to overflow. The bed of the stream is composed of gravel and is permanent. The bench mark for the gage at the cable is the top of a granite bowlder 20 feet south of the gage. Its elevation is 8.10 feet above the zero of the gage. The bench mark for the new inclined gage is the top of a bowlder 2 feet east of the gage. Its elevation is 9.94 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Carson River (East Fork) near Gardnerville, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 12	L. A. Woolley	89	222	2.04	4.08	453
May 3	R. A. Craig	73	197	2.77	4.22	546
May 12	do	80	338	6.13	6.15	2,071
July 4	J. T. Shaw	91	296	3.45	5.01	1,023
July 14	do	90	233	2.63	4.50	613
July 19	do	90	245	2.84	4.59	697
July 28	do	89	219	2.18	4.30	477
August 2[a]	do	87	226	2.19	4.46	495
August 11[a]	do	85	195	1.43	4.03	279
August 16[a]	do		191	1.32	4.04	252
August 25[a]	do		210	.99	4.16	207
September 7[a]	do		143	.83	3.50	119
September 22[a]	do		194	.76	4.05	147
October 15	do		205	1.78	4.20	366

[a] Temporary dam in stream below station affects measurements.

Mean daily gage height, in feet, of Carson River (East Fork) near Gardnerville, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.40	2.80	4.50	4.22	4.28	6.20	4.28	4.34	3.10	4.35	3.65	2.55
2	2.40	2.90	4.65	4.20	4.24	6.24	4.18	4.74	3.00	4.45	3.60	2.55
3	2.40	2.98	4.75	4.25	4.24	6.35	4.32	4.74	2.98	4.28	3.60	2.55
4	2.45	3.00	4.75	4.35	4.28	6.42	5.04	4.65	3.30	4.26	3.60	2.00
5	2.50	2.90	4.40	4.35	4.62	6.48	4.97	5.09	3.50	4.22	3.58	2.00
6	2.50	2.90	4.15	4.42	5.10	5.42	4.88	4.88	3.60	4.16	3.52	2.00
7	2.50	2.90	4.20	4.48	5.30	5.52	4.94	4.60	3.75	4.07	3.35	2.00
8	2.48	3.00	4.35	4.52	5.48	5.52	4.97	4.44	3.85	4.00	3.30	2.00
9	2.48	3.15	4.70	4.56	5.62	5.48	4.70	4.60	3.94	4.15	3.27	2.00
10	2.80	3.25	4.60	4.58	5.85	5.25	4.65	4.55	3.98	4.23	3.22	2.00
11	2.80	3.35	4.62	5.08	6.10	4.95	4.72	4.35	4.00	4.35	3.12	2.10
12	2.78	3.45	4.62	5.40	6.38	4.90	4.62	4.00	4.00	4.71	3.10	2.10
13	2.75	3.80	4.50	5.65	6.60	4.42	4.58	3.85	4.12	4.58	3.05	2.05
14	2.80	3.85	4.05	5.62	6.95	3.98	4.55	3.88	4.25	4.46	3.05	2.12
15	2.78	3.85	4.12	5.48	6.75	3.58	4.48	3.94	4.60	4.37	2.95	2.12
16	2.75	5.80	4.18	5.38	6.55	3.38	4.42	3.97	4.60	4.32	2.95	2.10
17	2.70	5.20	4.40	5.32	6.45	3.29	4.48	4.22	4.58	4.31	2.85	2.10
18	2.68	4.82	4.75	5.25	6.25	3.08	4.52	4.21	4.63	4.30	2.80	2.10
19	2.65	4.68	5.00	5.20	6.18	4.50	4.58	4.24	4.62	4.28	2.80	2.00
20	2.62	4.55	4.95	5.12	5.90	5.05	4.68	4.19	4.62	4.28	2.78	2.00
21	2.62	4.85	4.80	4.90	6.90	5.58	4.75	4.10	4.61	4.27	2.75	2.00
22	2.60	4.95	4.68	4.65	7.05	5.65	4.85	4.00	4.60	4.26	2.75	2.00
23	2.60	5.40	4.38	4.45	7.12	5.38	4.88	3.90	4.62	4.24	2.72	2.00
24	2.70	7.30	4.32	4.50	7.02	5.05	4.65	3.92	4.64	4.20	2.70	2.05
25	2.65	4.95	4.10	4.52	6.70	4.40	4.18	3.83	4.60	4.10	2.70	2.10
26	2.65	4.80	4.05	4.48	6.40	4.18	4.40	3.78	4.51	3.95	2.70	2.20
27	2.68	5.05	4.22	4.42	6.36	4.22	4.31	3.52	4.42	3.85	2.70	2.25
28	2.68	4.30	4.68	4.37	6.50	4.29	4.28	3.41	4.34	3.75	2.80	2.30
29	2.70	4.40	4.80	4.45	6.35	4.28	4.22	3.37	4.25	3.68	2.75	2.28
30	2.70	.....	4.50	4.38	6.32	4.28	4.20	3.34	4.30	3.62	2.65	2.29
31	2.85	.....	4.28	.....	6.28	.....	4.14	3.31	.....	3.65	.....	2.34

NOTE.—Beginning August 1 the gage heights were affected by temporary dam below the station.

Rating table for Carson River (East Fork) near Gardnerville, Nev., from January 1 to July 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	8	3.40	114	4.80	833	6.20	2,130
2.10	9	3.50	134	4.90	915	6.30	2,230
2.20	11	3.60	158	5.00	1,000	6.40	2,330
2.30	14	3.70	186	5.10	1,085	6.50	2,430
2.40	18	3.80	218	5.20	1,175	6.60	2,540
2.50	23	3.90	254	5.30	1,265	6.70	2,650
2.60	29	4.00	295	5.40	1,355	6.80	2,760
2.70	36	4.10	342	5.50	1,450	6.90	2,870
2.80	43	4.20	397	5.60	1,545	7.00	2,980
2.90	51	4.30	459	5.70	1,640	7.20	3,200
3.00	60	4.40	527	5.80	1,735	7.40	3,420
3.10	71	4.50	600	5.90	1,830		
3.20	83	4.60	675	6.00	1,930		
3.30	97	4.70	753	6.10	2,030		

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during first part of 1904 and several low-water measurements of 1903. It is well defined between gage heights 3.00 feet and 5.00 feet. The table has been extended beyond these limits. Owing to back water effect of temporary dam the table is not applicable after July 31, 1904.

Estimated monthly discharge of Carson River (East Fork) near Gardnerville, Nev., for 1904.

[Drainage area, 381 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	47	18	31.9	1,962	0.084	0.097
February	3,310	43	585	33,650	1.54	1.66
March	1,000	318	602	37,020	1.58	1.82
April	1,592	397	816	48,560	2.14	2.39
May	3,112	422	1,984	122,100	5.21	6.01
June	2,410	69	1,041	61,940	2.74	3.06
July	1,034	364	663	40,770	1.74	2.01
The period				345,900		

CARSON RIVER NEAR EMPIRE, NEV.

This station was established October 21, 1900, by L. H. Taylor. The original gage was located upstream from the site of the present station. On February 18, 1901, the erosion of a bar in the channel above the gage caused a division of the stream into two channels. On this account the present gage was installed on March 13, 1901. It is located about three-fourths mile east of Brunswick Mill and 2½ miles east of Empire, Nev. The gage is an inclined 4 by 4 inch timber spiked to a cottonwood stump on the left bank. The gage datum was lowered 1.3 feet August 11, 1903, to enable readings to be made at extreme low water. It is read once each day by David Lloyd. Discharge measurements are made by means of a cable and car just below the gage. The initial point for soundings is zero of the tagged wire on the left bank. The channel is straight for 100 feet above and below the station. Both banks are high, rocky, and will not overflow. The bed of the stream is composed of solid rock, gravel, and cobblestones and is not likely to shift. At flood stages the stream is too deep and swift to obtain the best results. At low water the stream is sluggish at the cable, and measurements are made by wading, one-fourth mile below. Bench mark No. 1 is the top of a bowlder on the left bank 2 feet west of the gage. Its elevation is 7.10 feet above the zero of the gage, as originally established, and 8.40 feet above the zero of the gage in its present position. Bench mark No. 2 is the top of a bowlder on the left bank 10 feet north of the gage. Its elevation is 8.38 feet above the zero of the gage, as originally established, and 9.68 feet above the zero of the gage in its present position.

The observations at this station during 1904 have been made under the direction of A. E. Chandler, district hydrographer.

Discharge measurements of Carson River near Empire, Nev., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 28	L. A. Wooley	80	288	3.39	4.62	976
April 30	R. A. Craig	70	261	3.15	4.10	821
May 7	do	68	289	3.99	4.72	1,154
July 1	J. T. Shaw	80	337	3.86	4.70	1,302
July 9	do	84	291	3.14	4.35	913
July 16	do	79	233	2.30	3.64	536
July 23	do	74	229	2.34	3.64	537
July 30	do	66	192	1.79	3.15	344
August 6	do	62	147	1.31	2.69	193
August 13	do		139	1.06	2.45	147
August 27	do		119	.84	2.18	100
September 14	do		20	2.30	1.90	46
October 28	do		199	1.79	3.20	[illegible]

Mean daily gage height, in feet, of Carson River near Empire, Nev., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.80	2.60	4.30	4.30	4.10	5.80	4.70	3.00	2.10	3.00	3.10	2.90
2	2.80	2.60	4.10	4.20	4.10	5.70	4.70	2.90	2.00	3.40	3.10	2.90
3	2.80	2.70	4.30	4.10	4.00	5.80	4.60	2.90	2.00	3.40	3.10	2.90
4	2.80	2.70	4.30	4.00	4.00	6.00	4.40	2.80	2.00	3.10	3.10	2.90
5	2.80	2.70	4.30	4.00	4.20	5.90	4.20	2.80	2.00	3.10	3.10	2.90
6	2.80	2.80	4.10	4.00	4.40	5.70	4.30	2.70	2.00	3.00	3.00	2.90
7	2.80	2.70	4.10	4.10	4.90	5.90	4.40	2.50	2.00	3.10	3.00	2.90
8	2.70	2.60	4.40	4.10	5.00	5.90	4.30	2.30	2.00	3.52	3.00	2.90
9	2.70	2.60	4.50	4.20	5.20	5.70	4.30	2.30	1.90	3.50	3.00	2.90
10	2.70	2.60	4.70	4.30	5.40	5.50	4.20	2.40	1.80	3.40	3.00	2.90
11	2.70	2.70	5.00	4.50	5.60	5.80	4.10	2.40	1.70	3.40	3.00	2.80
12	2.70	3.30	4.90	4.80	5.80	5.60	4.00	2.40	1.70	4.40	3.00	2.80
13	2.70	4.00	4.70	5.00	5.90	5.60	3.90	2.50	1.70	4.00	3.00	2.80
14	2.70	3.60	4.50	5.30	6.10	5.50	3.80	2.50	1.70	3.80	3.00	2.70
15	2.70	3.20	4.30	5.60	6.30	5.50	3.80	2.30	1.80	3.70	3.00	2.70
16	2.70	4.20	4.10	5.80	6.40	5.60	3.50	2.20	1.90	3.60	2.90	2.70
17	2.70	5.20	4.00	5.10	6.30	5.60	3.40	2.20	2.00	3.52	2.90	2.70
18	2.70	3.80	4.00	4.90	6.30	5.50	3.40	2.30	2.00	3.40	2.90	2.70
19	2.60	3.40	4.60	5.00	6.20	5.40	3.40	2.40	2.00	3.30	2.90	2.70
20	2.60	3.30	5.10	4.90	5.90	5.30	3.40	2.50	2.00	3.30	2.90	2.70
21	2.60	3.20	5.60	4.80	5.70	5.40	3.40	2.40	2.00	3.30	2.80	2.70
22	2.60	3.80	4.90	4.70	5.80	5.30	3.50	2.30	2.00	3.30	2.80	2.80
23	2.60	5.00	4.60	4.50	6.20	5.30	3.60	2.30	2.10	3.30	2.80	2.80
24	2.60	5.80	4.40	4.40	6.60	5.30	3.50	2.30	2.10	3.30	2.80	2.80
25	2.50	6.90	4.30	4.30	6.60	5.10	3.50	2.20	2.40	3.30	2.80	2.70
26	2.50	6.70	4.30	4.40	6.80	4.90	3.40	2.20	2.50	3.20	2.90	2.70
27	2.50	5.30	4.30	4.40	6.20	4.80	3.40	2.20	2.80	3.20	2.90	2.70
28	2.40	5.00	4.40	4.30	5.80	4.80	3.40	2.20	2.70	3.20	2.90	2.70
29	2.40	4.50	4.60	4.20	5.60	4.80	3.30	2.30	2.70	3.10	2.90	2.70
30	2.50	.....	4.80	4.20	5.80	4.70	3.10	2.30	2.80	3.10	2.90	3.00
31	2.60	.....	4.50	.....	5.80	.....	3.10	2.20	.....	3.10	.....	3.40

Rating table for Carson River near Empire, Nev., from January 1, 1904, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.70	30	2.90	251	4.10	765	5.30	1,700
1.80	40	3.00	281	4.20	825	5.40	1,790
1.90	51	3.10	313	4.30	889	5.50	1,885
2.00	63	3.20	347	4.40	956	5.60	1,980
2.10	77	3.30	384	4.50	1,026	5.70	2,075
2.20	93	3.40	423	4.60	1,100	5.80	2,170
2.30	110	3.50	464	4.70	1,180	5.90	2,265
2.40	129	3.60	508	4.80	1,260	6.00	2,360
2.50	150	3.70	554	4.90	1,345	6.20	2,550
2.60	173	3.80	603	5.00	1,430	6.40	2,750
2.70	197	3.90	654	5.10	1,520	6.60	2,950
2.80	223	4.00	708	5.20	1,610	6.80	3,150

The above table is applicable only for open-channel conditions. It is based upon 24 discharge measurements made during 1902 to 1904, inclusive. It is well defined between gage heights 1.70 feet and 5.40 feet. The table has been extended above gage height 5.40 feet.

Estimated monthly discharge of Carson River near Empire, Nev., for 1904.

[Drainage area, 988 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	223	129	187	11,500	0.189	0.218
February	3,250	173	792	45,560	.802	.865
March	1,980	708	1,035	63,640	1.05	1.21
April	2,170	708	1,094	65,100	1.11	1.24
May	3,150	708	2,006	123,300	2.03	2.34
June	2,360	1,180	1,852	110,200	1.87	2.09
July	1,180	313	638	39,230	.646	.745
August	281	93	139	8,547	.141	.163
September	223	30	82.4	4,903	.083	.093
October	956	281	420	25,820	.425	.490
November	313	223	267	15,890	.270	.301
December	423	197	229	14,080	.232	.268
The year	3,250	30	728	527,800	.737	10.02

SUSAN RIVER NEAR SUSANVILLE, CAL.

This station was established June 3, 1900, by L. H. Taylor, at which time a temporary gage was installed on the right bank. It is located about three-fourths mile southwest of Susanville, at the electric-light plant. A short distance above the station a small irrigating ditch, known as the "Masten ditch," is taken out on the right bank. There is a flume near its head in which a gage has been placed. On December 20, 1903, the station at the electric-light plant was reestablished by H. E. Green. A new gage was set which was made to read 2 feet more than original gage. A cable was installed for high-water measurements. The initial point for soundings is a post in the fence in line with the cable. The cable support on the left bank is 34.8 feet from the initial point for soundings. The channel is straight for 150 feet above and for 250 feet below the cable. The current is swift. There is a riffle immediately above the cable. The right bank is high and is composed of clay covered with vegetation. It is not liable to overflow. The left bank is low, liable to overflow, and is covered with a sparse growth of willows. The bed of the stream is composed of gravel and cobblestones and is permanent. Bench mark No. 1 is a nail in the fence post, which is used as the initial point for soundings. Its elevation is 11.35 feet above the zero of the gage. Bench mark No. 2 is a nail in the cable post. Its elevation is 9.00 feet above the zero of the gage. Bench mark No. 3 is a nail in the cottonwood tree

to which the cable is attached. Its elevation is 10.00 feet above the zero of the gage. The gage is read once each day by James Branham.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Susan River near Susanville, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 21	James Branham	5.30	106
February 28	do	6.40	298
March 29	do	7.55	716
June 16	S. G. Bennett and J. S. Evans	5.60	180
June 29	James Branham	4.95	96
July 31	do	4.20	27
August 10	do	4.50	53
September 11	do	3.85	11
October 25	W. B. Clapp and J. Y. Toler	4.10	23

Mean daily gage height, in feet, of Susan River near Susanville, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.30	4.20	6.20	6.85	6.25	6.05	4.90	4.10	3.90	4.00	4.10	4.30
2	4.25	4.20	6.80	6.90	6.15	6.00	5.20	4.10	3.85	4.00	4.20	4.30
3	4.25	4.20	7.00	6.90	6.15	5.95	5.20	4.05	3.80	4.00	4.10	4.20
4	4.25	4.20	7.55	7.05	6.20	5.90	5.20	4.20	3.80	4.00	4.10	4.10
5	4.20	4.25	7.20	7.00	6.30	5.90	5.10	4.50	3.80	4.00	4.10	4.10
6	4.20	4.25	7.45	7.15	6.85	5.80	5.15	4.50	3.80	4.00	4.10	4.10
7	4.20	4.25	7.80	7.15	7.30	5.80	5.10	4.50	3.80	4.10	4.10	4.10
8	4.20	4.25	8.70	7.30	7.35	5.75	4.65	4.50	3.80	4.10	4.10	4.10
9	4.20	4.25	7.75	7.45	7.50	5.70	4.50	4.50	3.80	4.10	4.10	4.10
10	4.25	4.25	7.50	7.80	7.55	5.70	4.50	4.50	3.80	4.20	4.10	4.10
11	4.30	4.25	7.00	8.05	7.80	5.60	4.40	4.40	3.90	4.55	4.10	4.05
12	4.30	4.30	6.70	8.25	7.95	5.50	4.40	4.40	3.95	4.40	4.10	4.05
13	4.30	4.30	6.45	8.60	8.15	5.50	4.35	4.40	3.95	4.30	4.10	4.10
14	4.30	4.30	6.55	8.80	8.20	5.50	4.30	4.40	3.95	4.30	4.10	4.10
15	4.25	5.60	6.70	8.95	8.10	5.45	4.30	4.40	3.95	4.20	4.10	4.10
16	4.25	9.00	6.35	8.50	8.05	5.50	4.30	4.40	3.95	4.25	4.20	4.10
17	4.25	6.70	7.85	8.25	7.90	5.50	4.30	4.40	3.95	4.25	4.20	4.05
18	4.25	6.20	8.80	8.25	7.85	5.40	4.30	4.40	3.95	4.20	4.15	4.05
19	4.25	5.65	9.00	8.30	7.55	5.40	4.30	4.40	4.00	4.20	4.15	4.00
20	4.30	5.35	8.45	7.75	7.40	5.35	4.30	4.40	4.00	4.15	4.15	4.00
21	4.30	5.85	7.75	7.45	7.40	5.30	4.25	4.40	4.00	4.15	4.10	4.00
22	4.30	9.90	7.45	7.25	7.30	5.30	4.20	4.40	4.00	4.10	4.10	4.00
23	4.30	7.85	7.10	7.05	7.30	5.30	4.20	4.40	4.20	4.10	4.10	4.05
24	4.30	9.65	6.80	6.90	7.30	5.30	4.30	4.40	4.40	4.10	4.10	4.05
25	4.30	8.20	6.70	6.85	7.20	5.20	4.60	4.40	4.30	4.10	4.10	4.05
26	4.30	7.50	6.65	6.80	7.05	5.10	4.55	4.25	4.20	4.10	4.10	4.10
27	4.25	6.95	6.70	6.75	6.80	5.00	4.50	4.00	4.10	4.10	4.25	4.10
28	4.20	6.40	7.85	6.65	6.70	5.00	4.45	4.00	4.10	4.10	4.20	4.10
29	4.20	6.20	7.55	6.65	6.50	4.90	4.45	3.95	4.05	4.10	4.20	4.10
30	4.20	.....	7.30	6.25	6.40	4.90	4.40	3.90	4.05	4.10	4.20	7.60
31	4.20	.....	6.95	.....	6.25	.....	4.25	3.90	.....	4.10	.....	5.45

Rating table for Susan River near Susanville, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.60	6	5.00	92	6.40	350	7.70	760
3.70	8	5.10	104	6.50	375	7.80	800
3.80	10	5.20	116	6.60	400	7.90	840
3.90	13	5.30	128	6.70	430	8.00	880
4.00	16	5.40	142	6.80	460	8.20	960
4.10	20	5.50	156	6.90	490	8.40	1,040
4.20	24	5.60	172	7.00	520	8.60	1,120
4.30	30	5.70	190	7.10	550	8.80	1,200
4.40	36	5.80	210	7.20	585	9.00	1,300
4.50	42	5.90	230	7.30	620	9.20	1,400
4.60	50	6.00	250	7.40	655	9.40	1,500
4.70	60	6.10	275	7.50	690	9.60	1,600
4.80	70	6.20	300	7.60	725	9.80	1,700
4.90	80	6.30	325				

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1903 and 1904. It is fairly well defined between gage heights 4.00 feet and 7.50 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Susan River near Susanville, Cal., 1903 and 1904.

[Drainage area, 256 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
January	388	36	90	5,534	0.35	0.40
March	1,800	36	205	12,605	.80	.92
April	620	288	372	22,136	1.45	1.62
May	445	122	266	16,356	1.04	1.20
June	116	20	63	3,749	.25	.28
July	20	6	11	676	.04	.05
August	8	6	7	430	.03	.03
September	12	8	11	655	.04	.05
October	18	12	17	1,045	.07	.08
November	725	18	137	8,152	.54	.60
December	92	30	42	2,582	.16	.18
The period				73,920		

NOTE.—River frozen during February

Estimated monthly discharge of Susan River near Susanville, Cal., 1903 and 1904—Con.

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1904.						
January	30	24	27	1,660	0.11	0.13
February	1,750	24	349	20,075	1.36	1.47
March	,300	300	629	38,676	2.46	2.84
April	1,275	312	695	41,355	2.71	3.02
May	960	288	600	36,893	2.34	2.70
June	262	80	160	9,521	.62	.69
July	116	27	51	3,136	.20	.23
August	42	13	31	1,906	.12	.14
September	36	10	16	952	.06	.07
October	46	16	22	1,353	.09	.10
November	27	20	21	1,250	.08	.09
December	725	16	47	2,890	.18	.21
The year	1,750	10	221	159,667	.86	11.69

WILLOW CREEK AT MERRILLVILLE, CAL.

This station was established June 18, 1904, by S. G. Bennett. It is located at the old bridge 100 feet above the present wagon bridge. The gage is a 2 by 4 inch vertical rod fastened to the left end of the bridge. It is read once each day by R. W. Hurlbut. Discharge measurements are made from the bridge. The initial point for soundings is on the left bank of the stream. The distance across the stream is marked on the foot bridge at intervals of 2 feet. The channel is straight above and below the bridge for a distance of 100 feet. The banks on each side are low, but not subject to overflow, as there is very little fluctuation in the discharge of the creek. The bed of the stream is composed of gravel and is not subject to much change.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Willow Creek at Merrillville, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 18	S. G. Bennett	1.00	19.0
July 17	James Branham	.95	14.9
August 29	do	1.05	17.9
October 25	J. Y. Toler and W. B. Clapp	1.07	19.3

Mean daily gage height, in feet, of Willow Creek at Merrillville, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.00	1.00	1.00	1.05	1.10	1.10
2	1.00	1.00	1.10	1.05	1.10	1.10
3	1.00	1.05	1.10	1.05	1.10	1.05
4	1.00	1.00	1.05	1.05	1.10	1.05
5	1.00	1.00	1.05	1.05	1.10	1.05
6	1.05	1.00	1.05	1.10	1.05	1.05
7	1.00	.95	1.10	1.10	1.10	1.05
8	1.00	1.05	1.05	1.05	1.05	1.05
9	1.00	1.05	1.05	1.10	1.10	1.10
10	.95	1.00	1.10	1.10	1.10	1.05
11	1.10	1.00	1.05	1.05	1.10	1.05
12	1.15	1.00	1.00	1.05	1.10	1.05
13	1.20	1.00	1.00	1.05	1.10	1.10
14	1.10	1.00	1.05	1.10	1.10	1.10
15	1.10	1.00	1.05	1.20	1.10	1.05
16	1.10	1.00	1.05	1.10	1.10	1.05
17	1.00	1.05	1.05	1.05	1.05	1.05
18	1.00	1.00	1.05	1.05	1.10	1.05
19	1.00	1.00	1.00	1.05	1.10	1.05
20	1.00	1.00	1.00	1.05	1.10	1.05
21	1.05	1.00	1.05	1.05	1.10	1.05
22	1.00	1.00	1.05	1.05	1.10	1.05
23	1.00	1.00	1.10	1.05	1.05	1.10
24	1.00	1.00	1.10	1.05	1.05	1.10
25	1.00	1.05	1.10	1.05	1.05	1.05
26	1.00	1.00	1.05	1.05	1.05	1.00
27	1.00	1.00	1.05	1.10	1.10	1.05
28	1.00	1.00	1.05	1.05	1.10	1.05
29	1.05	1.00	1.05	1.10	1.10	1.20
30	1.00	1.05	1.00	1.10	1.10	1.70
31	1.00	1.00	.....	1.10	.....	1.20

Rating table for Willow Creek at Merrillville, Cal., from July 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.90	16	1.00	18	1.10	20	1.20	22

Estimated monthly discharge of Willow Creek at Merrillville, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
July	22	17	19	1,168
August	19	17	18	1,107
September	20	18	19	1,131
October	22	19	19	1,168
November	20	19	20	1,190
December	50	19	20	1,230
The period	50	17	19	6,994

SILVER CREEK NEAR SILVERLAKE, OREG.

This station was established December 29, 1904, by W. C. Sawyer. It is located 0.9 mile above the county highway bridge and 1.6 miles southwest of Silverlake post-office, Oreg. An inclined staff gage, 16 feet long, is fastened at the east bank. The slope of the gage is 2.296 feet to 1 foot vertical. The gage is read once each day by Henry Egli. Discharge measurements are made by means of a cable and car. The initial point for soundings is 9.2 feet west from the anchor bolt at the east end of the cable. The channel is straight for 100 feet above and 75 feet below the station. The current is swift. Both banks are high, rocky, clean, and do not overflow. The bed of the stream is composed of rock and gravel, free from vegetation, and permanent. There is but one channel at all stages. The bench mark is a copper bolt cemented in solid rock on the east side of the stream, 43 feet downstream from the cable, and 12 feet from the edge of low water. Its elevation is 8.12 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

MALHEUR LAKE AT THE NARROWS, OREGON.

This station was established May 14, 1903, by N. S. Dils. It is located at the highway bridge across The Narrows. The gage is a 1 by 4 inch board 10 feet long, fastened to a telegraph pole. It is read from the bridge once each day by C. A. Haines, the postmaster. The bench mark is a United States Geological Survey standard iron bench-mark post set at the east end of the bridge on the south side of the road near the fence and about 200 feet from the gage. Its elevation is 8.20 feet above the zero of the gage and 4,088 feet above sea level. This station is maintained for the purpose of obtaining data of

the lake fluctuations. The lake has no outlet. No discharge measurements are made at this station.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Mean daily gage height, in feet, of Malheur Lake at The Narrows, Oregon, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.80	1.60	1.90	5.60	.....	7.00	6.70	6.30	5.70	5.40	5.60
2	1.70	1.60	1.90	5.70	.....	7.00	6.70	6.30	5.70	5.40	5.60
3	1.70	1.60	1.90	5.80	.....	7.00	6.70	6.20	5.70	5.40	5.60
4	1.70	1.60	1.90	5.90	.....	7.00	6.70	6.20	5.70	5.40	5.60
5	1.70	1.60	1.90	5.90	.....	7.00	6.70	6.20	5.70	5.40	5.60
6	1.70	1.60	2.00	6.00	.....	7.00	6.60	6.20	5.60	5.40	5.60
7	1.70	1.70	2.00	6.00	.....	7.00	6.60	6.20	5.60	5.40	5.60
8	1.70	1.70	2.00	6.10	7.20	7.00	6.60	6.20	5.50	5.40	5.60
9	1.70	1.70	2.00	6.10	7.20	7.00	6.60	6.20	5.50	5.40	5.60
10	1.70	1.70	2.00	6.20	7.20	7.00	6.60	6.10	5.50	5.40	5.60
11	1.70	1.70	2.00	6.20	7.20	7.00	6.60	6.10	5.50	5.40	5.60
12	1.70	1.70	2.00	6.30	7.30	6.90	6.60	6.10	5.50	5.40	5.60
13	1.70	1.70	2.10	6.30	7.30	6.90	6.50	6.10	5.50	5.40	5.60
14	1.70	1.80	2.10	6.40	7.30	6.90	6.50	6.00	5.40	5.40	5.60
15	1.70	1.80	2.20	6.40	7.30	6.90	6.50	6.00	5.40	5.40	5.60
16	1.70	1.80	2.20	6.40	7.30	6.80	6.50	6.00	5.40	5.40	5.60
17	1.60	1.80	2.30	6.50	7.20	6.80	6.50	6.00	5.40	5.40	5.60
18	1.60	1.80	2.30	6.50	7.20	6.80	6.50	5.90	5.40	5.30	5.70
19	1.60	1.80	2.30	6.60	7.10	6.80	6.50	5.90	5.40	5.30	5.10
20	1.60	1.80	2.40	6.60	7.10	6.80	6.45	5.90	5.40	5.30	5.10
21	1.60	1.90	2.40	6.70	7.10	6.80	6.45	5.90	5.40	5.30	.....
22	1.60	1.90	2.40	6.70	7.10	6.80	6.45	5.90	5.40	5.30	.....
23	1.60	1.90	2.50	6.80	7.10	6.80	6.45	5.90	5.40	5.30	.....
24	1.60	1.90	2.50	6.90	7.10	6.80	6.45	5.80	5.40	5.30	.....
25	1.60	1.90	2.50	7.00	7.10	6.80	6.45	5.80	5.40	5.30	.....
26	1.60	1.90	2.50	7.10	7.10	6.80	6.45	5.80	5.40	5.30	.....
27	1.60	1.90	2.60	7.10	7.10	6.80	6.45	5.80	5.40	5.30	.....
28	1.60	1.90	5.10	7.20	7.10	6.80	6.40	5.80	5.40	5.30	.....
29	1.60	1.90	5.10	7.20	7.10	6.70	6.40	5.80	5.40	5.30	.....
30	1.60	.....	5.30	7.20	7.10	6.70	6.40	5.80	5.40	5.30	.....
31	1.60	.....	5.40	.....	7.10	.....	6.30	5.70	.....	5.30	.....

SILVIES RIVER NEAR SILVIES, OREG.

A temporary station was established May 8, 1903, by N. S. Dils, one-half mile above the present gage. Gage heights were read by John Craddock from May 8 to June 26, 1903. One discharge measurement was made at the temporary station. On June 16, 1903, a permanent gage was established by M. D. Williams at the proposed dam site one-half mile below the temporary gage. The station is 2 miles west of the stage road and three-fourths mile below the mouth of Trout Creek. There is a dam 1½ miles upstream. The gage is an inclined 2 by 6 inch plank on the left bank. It is read once each day by John Craddock. Discharge measurements are made by means of

a ⅝-inch cable having a total span of 494 feet. It is supported near the center. The cable is located 75 feet downstream from the gage. The initial point for soundings is the zero on the tagged wire, 29 feet from the cable support. The channel is straight for 150 feet above and for 200 feet below the station. The right bank is low and will overflow at high water for a considerable distance. The left bank is high, rocky, and is not liable to overflow. All water passes beneath the cable at all stages. The bed of the stream is composed of gravel, free from vegetation, and liable to shift. No bench mark has been established.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Silvies River near Silvies, Oreg., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Square feet.	*Ft. per sec.*	*Feet.*	*Second-feet.*
March 12	M. L. Lewis	265	1.40	6.35	375
March 13	do	240	1.40	5.80	336
March 22	do	295	1.60	6.86	460
April 2	do	181	1.76	5.75	319
April 8	do	425	1.52	8.65	647
April 8	do	415	1.57	8.40	653
April 9	do	393	1.78	8.91	699
April 10	do	591	1.63	8.99	965
April 13	J. H. and M. L. Lewis	1,590	1.18	11.30	1,870
April 28	M. L. Lewis	1,030	1.10	10.02	1,170
May 7	do	402	1.80	8.65	723
May 13	do	333	1.60	7.58	534
May 24	do	248	1.50	6.05	371
June 2	do	216	1.21	5.44	262
June 9	do	197	1.16	4.98	229
June 16	do	143	.80	3.80	115
June 29	W. C. Sawyer	30	1.13	2.94	34
September 15 [a]	do	3.3	1.18	2.22	3.9
November 5	Ivan Landes	27	.53	2.80	14

[a] Wading at different section.

Mean daily gage height, in feet, of Silvies River near Silvies, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.20	3.40	4.45	5.85	9.85	5.25	2.80	2.60	2.25	2.60	2.85	2.95
2	3.20	3.40	4.35	5.40	9.85	5.40	2.85	2.60	2.25	2.60	2.85	2.95
3	3.20	3.55	3.95	6.85	9.75	5.35	3.00	2.60	2.25	2.60	2.85	2.95
4	3.20	3.65	3.95	6.65	9.10	5.25	3.10	2.60	2.20	2.60	2.85	3.50
5	3.20	3.65	3.95	6.85	8.95	5.05	3.15	2.50	2.20	2.65	2.85	3.50
6	3.20	3.65	5.85	6.85	8.80	5.05	3.20	2.50	2.20	2.70	2.85	3.50
7	3.20	3.65	8.40	8.80	8.65	5.00	3.25	2.50	2.20	2.75	2.85	3.00
8	3.20	3.65	9.85	8.75	8.50	5.05	3.20	2.45	2.20	2.75	2.85	3.00
9	3.20	3.65	8.90	9.20	8.40	5.00	3.20	2.40	2.20	2.80	2.80	3.00
10	3.20	3.65	8.10	10.15	8.30	4.65	3.20	2.40	2.20	2.80	2.80	3.00
11	3.20	3.65	6.85	10.30	8.05	4.45	3.10	2.40	2.20	2.80	2.80	3.00
12	3.20	3.65	6.35	10.60	7.90	4.40	3.10	2.40	2.20	2.85	2.80	3.00
13	3.20	3.65	6.35	11.10	7.80	4.30	3.10	2.35	2.20	2.85	2.80	3.00
14	3.20	3.65	6.65	12.05	7.35	4.05	3.10	2.35	2.20	2.85	2.80	3.00
15	3.20	8.70	6.85	12.10	7.15	4.05	3.10	2.35	2.20	2.85	2.80	3.00
16	3.20	8.50	6.85	12.15	7.05	3.80	2.95	2.30	2.20	2.85	2.85	3.00
17	3.20	6.45	6.25	11.75	6.85	3.95	3.00	2.30	2.20	2.85	2.90	3.00
18	3.20	4.35	6.20	11.50	6.75	3.75	3.00	2.20	2.20	2.85	2.90	3.25
19	3.20	3.65	6.85	11.10	6.65	3.50	3.00	2.20	2.25	2.85	2.90	3.20
20	3.20	3.65	7.05	11.20	6.45	3.50	3.00	2.20	2.30	2.85	2.95	3.20
21	3.20	3.65	6.45	11.00	6.35	3.40	2.90	2.20	2.30	2.85	2.95	3.20
22	3.20	9.45	5.65	10.80	6.35	3.40	2.85	2.20	2.30	2.85	2.95	3.20
23	3.20	10.80	4.90	10.50	6.25	3.35	2.80	2.30	2.30	2.85	2.95	3.20
24	3.40	8.80	4.55	9.95	6.15	3.30	2.80	2.30	2.30	2.85	2.95	3.20
25	3.40	7.90	4.85	9.95	6.10	3.30	2.80	2.25	2.30	2.85	2.95	3.20
26	3.40	7.45	4.85	9.85	6.05	3.25	2.75	2.25	2.35	2.85	2.95	3.20
27	3.40	5.95	4.85	9.75	5.85	3.10	2.70	2.25	2.40	2.85	2.95	3.20
28	3.40	5.05	4.85	9.85	5.65	3.50	2.60	2.25	2.45	2.85	2.95	3.20
29	3.40	4.85	5.45	9.85	5.45	2.95	2.55	2.25	2.50	2.85	2.95	3.20
30	3.40	.....	6.35	9.85	5.30	2.85	2.50	2.25	2.60	2.85	2.95	3.20
31	3.40	.....	6.45	.....	5.25	.....	2.50	2.25	.....	2.85	.....	4.10

Rating table for Silvies River near Silvies, Oreg., from January 1, 1904, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.20	3	3.60	78	4.90	208	6.20	358
2.30	5	3.70	87	5.00	220	6.30	369
2.40	7	3.80	97	5.10	231	6.40	381
2.50	9	3.90	107	5.20	242	6.50	393
2.60	12	4.00	117	5.30	254	6.60	405
2.70	16	4.10	127	5.40	265	6.70	417
2.80	20	4.20	137	5.50	276	6.80	429
2.90	25	4.30	147	5.60	288	6.90	441
3.00	31	4.40	157	5.70	299	7.00	453
3.10	37	4.50	167	5.80	311	7.20	477
3.20	45	4.60	177	5.90	322	7.40	502
3.30	53	4.70	187	6.00	334	7.60	526
3.40	62	4.80	197	6.10	346	7.80	551
3.50	70						

Rating table for Silvies River near Silvies, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
8.00	576	8.80	724	9.60	966	11.00	1,700
8.20	607	9.00	773	9.80	1,064	11.50	1,967
8.40	642	9.20	827	10.00	1,168	12.00	2,236
8.60	681	9.40	889	10.50	1,432		

The above table is applicable only for open-channel conditions. It is based upon 19 discharge measurements made during 1904. It is well defined between gage heights 2.20 feet and 10.00 feet. Above 10.00 feet the curve depends on one measurement at 11.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Silvies River near Silvies, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	62	45	49.4	3,038
February	1,592	62	286	16,460
March	1,090	112	355	21,830
April	2,316	265	1,242	73,910
May	1,090	248	530	32,590
June	265	22	132	7,855
July	49	9	29.0	1,783
August	12	3	6.2	381
September	12	3	4.4	262
October	22	12	19.8	1,218
November	28	20	24.0	1,428
December	127	28	43.6	2,681
The year	2,316	3	227	163,400

SILVIES RIVER NEAR BURNS, OREG.

This station was established as a temporary station by N. S. Dils, May 10, 1903. The permanent station was established August 14, 1903, by W. T. Turner. It is located about 10 miles above Burns, Oreg. On January 19, 1904, a new gage was installed together with a cable for discharge measurements by John H. Lewis. The present gage is on the left bank, 10 feet below the bridge, near Parker's house. The lower inclined section reads from 2 to 12.6 feet. The upper vertical section reads from 12.7 to 17 feet. Both sections consist of 2 by 6 inch timbers, supported by a frame which is secured to the bank. The gage is read once each day by Mrs. Leona Parker. Discharge measurements are made from a ⅜-inch cable with a span of 390

feet. It is located at Lampshir's place, 1 mile above the gage. Besides the timber supports at the ends of the cable it is supported at a point 167 feet from the initial point for soundings by a tree 10 inches in diameter. At high stages all water will pass beneath the cable. At low water the current is sluggish at the cable and discharge measurements are made by wading. The initial point for soundings is the zero of the tagged wire 22½ feet from the lower end of the turn-buckle. The channel is straight for 75 feet above and below the cable. The right bank is low and liable to overflow for a considerable distance. The left bank is high and rocky and will not overflow. Both banks have been cleared of brush. At the cable the bed of the stream is composed of sand, and is liable to shift. There is one channel at low water and two or more at high water. At the gage the bed of the stream is composed of clean sand and gravel. The bench mark is the highest point of a large rock on the right bank, directly across the river from the gage, from which it is 135 feet distant. Its elevation is 19.76 feet above the zero of the gage. The present gage was established on the same datum as the one which it replaced.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Silvies River near Burns, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square feet.*	*Ft. per sec.*	*Feet.*	*Second-feet.*
January 19	J. H. Lewis	26	29	1.50	2.85	[a]44
March 15	M. L. Lewis	56	546	1.15	9.30	630
March 25	do	52	400	.87	6.60	348
April 5	do	77	760	1.50	13.30	1,141
April 6	do	80	704	1.83	13.60	1,290
April 11	do	375	1,346	2.11	15.20	2,847
April 12	do	379	1,500	2.29	16.10	3,430
April 15	J. H. and M. L. Lewis.	434	2,350	2.10	17.10	4,925
May 5	M. L. Lewis	290	1,260	1.25	14.30	1,576
May 20	do	72	658	1.35	11.50	887
May 29	do	55	435	1.08	7.50	468
June 8	do	53	375	.98	5.80	342
June 12	do	52	338	.83	5.20	280
June 20	do	50	259	.56	3.75	144
June 23	do	50	232	.42	3.42	98
September 8	Sawyer & Lewis.	22	18	1.00	2.60	18
November 6	Landes & Hoyt.	44	45	1.10	2.80	49

[a] Wading at different section.

Mean daily gage height, in feet, of Silvies River near Burns, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.50	2.75	5.25	9.25	14.90	6.90	3.10	2.85	2.60	2.70	2.80	2.80
2	2.50	2.75	5.20	10.30	14.72	6.90	2.90	2.85	2.60	2.70	2.80	2.80
3	2.50	2.75	5.10	11.20	14.50	6.90	2.90	2.83	2.60	2.70	2.80	2.80
4	2.50	2.75	5.00	12.38	14.40	6.85	2.90	2.82	2.60	2.70	2.80	2.80
5	2.50	2.75	5.50	13.10	14.30	6.90	2.90	2.80	2.60	2.70	2.80	2.80
6	2.50	2.80	6.25	13.40	14.30	6.40	2.90	2.80	2.60	2.70	2.80	2.80
7	2.50	2.80	12.20	13.82	13.90	6.00	3.00	2.80	2.60	2.70	2.80	2.80
8	2.50	2.80	16.10	13.85	13.80	5.92	3.00	2.75	2.60	2.70	2.80	2.80
9	2.50	2.80	15.60	14.25	13.67	5.90	3.05	2.70	2.60	2.75	2.80	2.80
10	2.50	2.80	13.30	14.65	13.52	5.65	3.05	2.70	2.60	2.75	2.80	2.80
11	2.50	2.80	11.90	15.45	13.40	5.45	3.10	2.70	2.60	2.75	2.80	2.80
12	2.50	2.80	10.00	16.20	13.20	5.40	3.10	2.70	2.60	2.80	2.80	2.90
13	2.50	2.80	8.65	16.65	12.90	5.22	3.15	2.70	2.60	2.80	2.80	2.90
14	2.90	2.80	8.30	17.00	12.67	4.92	3.15	2.70	2.60	2.80	2.80	2.95
15	2.90	2.80	9.30	17.12	12.40	4.45	3.20	2.60	2.60	2.80	2.80	2.85
16	2.90	3.30	9.30	16.70	12.10	4.28	3.20	2.60	2.60	2.80	2.80	2.80
17	2.90	7.00	8.75	16.40	11.72	4.10	3.15	2.60	2.60	2.80	2.80	2.75
18	2.90	7.60	11.20	16.00	11.50	4.00	3.10	2.60	2.60	2.80	2.80	2.70
19	2.90	5.75	11.70	15.90	11.18	3.88	3.10	2.60	2.60	2.80	2.80	2.70
20	2.85	4.80	13.20	15.90	11.10	3.75	3.00	2.60	2.60	2.80	2.80	2.70
21	2.85	4.25	13.00	15.70	10.90	3.62	2.95	2.60	2.60	2.80	2.80	2.70
22	2.85	9.70	10.70	15.60	10.40	3.55	2.90	2.60	2.60	2.80	2.80	2.70
23	2.85	12.50	10.10	15.40	9.45	3.40	2.90	2.60	2.60	2.80	2.80	2.70
24	2.85	12.90	8.20	15.10	9.00	3.35	2.90	2.60	2.60	2.80	2.80	2.70
25	2.85	12.80	6.95	14.60	8.50	3.30	2.90	2.60	2.60	2.80	2.80	2.70
26	2.80	11.80	6.40	14.20	8.30	3.25	2.90	2.60	2.60	2.80	2.80	2.70
27	2.80	9.80	6.00	14.00	8.15	3.10	2.90	2.65	2.70	2.75	2.80	2.70
28	2.80	7.20	6.85	14.20	8.00	3.00	2.85	2.65	2.75	2.75	2.80	2.70
29	2.80	5.80	8.45	14.90	7.45	3.00	2.85	2.60	2.70	2.75	2.80	2.75
30	2.80	.....	10.72	15.00	7.10	3.00	2.85	2.60	2.70	2.80	2.80	2.80
31	2.75	.....	9.70	.....	6.90	.....	2.85	2.60	.....	2.80	.....	2.85

Rating table for Silvies River near Burns, Oreg., from January 1, 1904, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.50	6	4.10	152	6.40	363	10.50	750
2.60	15	4.20	161	6.60	382	11.00	805
2.70	24	4.30	170	6.80	400	11.50	865
2.80	33	4.40	179	7.00	419	12.00	930
2.90	42	4.50	189	7.20	437	12.50	1,005
3.00	51	4.60	198	7.40	455	13.00	1,095
3.10	60	4.70	207	7.60	474	13.50	1,220
3.20	69	4.80	216	7.80	493	14.00	1,440
3.30	78	4.90	225	8.00	512	14.50	1,900
3.40	87	5.00	235	8.20	530	15.00	2,440
3.50	97	5.20	253	8.40	549	15.50	2,980
3.60	106	5.40	271	8.60	568	16.00	3,520
3.70	115	5.60	290	8.80	587	16.50	4,060
3.80	124	5.80	308	9.00	606	17.00	4,600
3.90	133	6.00	327	9.50	653	17.50	5,140
4.00	143	6.20	345	10.00	700		

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1903 and 1904. It is not well defined.

Estimated monthly discharge of Silvies River near Burns, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	42	6	24.0	1,476
February	1,075	28	285	16,390
March	3,628	235	791	48,640
April	4,730	629	2,460	146,400
May	2,332	409	1,057	64,990
June	409	51	211	12,560
July	69	37	50.1	3,080
August	37	15	21.9	1,347
September	28	15	16.3	970
October	33	24	30.2	1,857
November	33	33	33.0	1,964
December	46	24	30.7	1,888
The year	4,730	6	418	301,600

SILVER CREEK NEAR RILEY, OREG.

This station was established April 19, 1904, by John H. Lewis. The gage is located at bridge No. 3, crossing the east or main channel of Silver Creek, on the Burns-Shaniko stage line, 12 miles above Riley, Oreg., and 6 miles below the proposed reservoir site on Silver Creek. A plain staff gage, graduated to feet and tenths, is attached vertically to timbers on the lower side of the bridge at the left bank. During 1904 the gage was read once each day by H. D. Cecil, Ben Mutter, and R. M. Cantrell. From April 19 to September 10, 1904, when the permanent gage was established, readings were obtained by measuring down to the water surface from a mark on the bridge floor with a rod so graduated as to give gage readings direct. Discharge measurements are made from three bridges over the three channels of the stream, in the line with the gage, and at high stages an additional slough is measured by wading. The initial point for soundings is the west end of the floor at each of the bridges. The channels are straight for about 80 feet above and 50 feet below the station, and the current is sluggish. Both banks are low, covered with sagebrush, and subject to overflow. The bed of the stream is composed of sandy clay, free from vegetation, and shifting. There are three channels at low water and four or more at extreme floods. The bench mark is a standard United States Geological Survey iron bench-mark post on the north side of the road in front of the house of the observer. Its elevation is 20.19 feet above the zero of the gage. The bench mark is 4,345 feet above sea level, datum II. The top of the floor of bridge No. 1 at the 21-foot mark is 4,339.87 feet above sea level, and 15.06 feet above the zero of the gage. The top of the floor of bridge No. 2 at the 20-foot mark is 4,338.69 feet above sea level, and 13.88 feet above the zero of the gage. The top of the floor of bridge No. 3 at the 30-foot mark is 4,339.81 feet above sea level and 15.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements on Silver Creek near Riley, Oreg., in 1903 and 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
1903.						
September 15					2.15	1.0
1904.						
April 16	J. H. Lewis		722	1.86	12.95	1,346
April 17	do		602	1.90	12.75	1,145
May 3	do	88	239	1.56	9.45	374
May 10	do	49	157	1.93	8.30	303
May 21	do	43	90	1.25	6.35	112
June 5	do	34	51	.84	5.30	43
June 15 [a]	M. L. Lewis	34	43	.77	5.00	33
June 25	W. C. Sawyer	26	26	.56	4.72	14
September 10 [b]	do	4	1.0	.75	4.37	.8
October 11	Landis and Cupper	5	6.7	.65	4.45	4.3
October 29	do	11	3.0	.97	4.40	3.0

[a] Measurement made from Bridge No. 3. [b] Measured by wading.

Mean daily gage height, in feet, of Silver Creek near Riley, Oreg., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		9.90	5.35	4.76			4.40	4.40	4.55
2		9.80	5.30	4.75			4.40	4.40	4.55
3		9.45	5.50	4.73				4.40	4.55
4		9.30	5.60	4.70			4.40	4.40	4.55
5		9.00	6.70	5.20			4.40	4.40	
6		8.75	6.50	6.20			4.40	4.40	4.55
7		8.60	6.45	6.75			4.40		4.55
8		8.50	5.30	6.74			4.40	4.45	4.50
9		8.35	5.31	6.73			4.40	4.50	4.55
10		8.30	5.29	6.72		4.37		4.50	4.55
11		8.05	5.32	6.71		4.40	4.40	4.50	4.55
12		7.80	5.25	6.50			4.40	4.50	
13		7.60	5.20	6.30		4.40	4.40	4.50	4.55
14	13.95	7.60	4.80	6.20		4.40	4.40		4.55
15	13.45	7.40	4.85	5.34		4.40	4.40	4.55	4.55
16	12.95	7.35	4.85	5.20		4.40	4.40	4.55	4.55
17	12.75	6.90	4.84			4.40		4.55	4.55
18	12.55	6.45	4.82			4.40	4.45	4.55	4.55
19	12.45	6.50	4.80				4.45	4.55	
20	12.30	6.35	4.76			4.40	4.45	4.55	4.55
21	11.90	6.30	4.75			4.40	4.40		4.55
22	11.40	6.25	4.73			4.40	4.40	4.55	4.60
23	10.95	6.20	4.74			4.40	4.40	4.55	5.00
24	10.45	6.15	4.73			4.40		4.55	5.00
25	10.05	6.10	4.72			4.40	4.40	4.55	5.00
26	10.75	6.20	4.71				4.40	4.55	
27	10.90	6.25	4.70			4.45	4.40	4.55	5.00
28	11.10	6.30	4.71			4.45	4.40		5.00
29	10.50	6.50	4.72			4.45	4.40	4.55	5.00
30	10.10	5.85	4.74			4.40	4.40	4.55	5.00
31		5.50							.00

Rating table for Silver Creek near Riley, Oreg., from April 14 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.30	0	5.80	78	7.30	184	9.60	424
4.40	2	5.90	84	7.40	192	9.80	452
4.50	6	6.00	90	7.50	200	10.00	480
4.60	10	6.10	96	7.60	208	10.20	512
4.70	14	6.20	102	7.70	216	10.40	544
4.80	18	6.30	108	7.80	225	10.60	578
4.90	24	6.40	114	7.90	235	10.80	614
5.00	30	6.50	120	8.00	245	11.00	650
5.10	36	6.60	128	8.20	265	11.50	758
5.20	42	6.70	136	8.40	285	12.00	890
5.30	48	6.80	144	8.60	305	12.50	1,061
5.40	54	6.90	152	8.80	326	13.00	1,290
5.50	60	7.00	160	9.00	350	13.50	1,540
5.60	66	7.10	168	9.20	374	14.00	1,790
5.70	72	7.20	176	9.40	398		

The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1904. It is fairly defined between gage heights 4.40 feet and 13.00 feet.

Estimated monthly discharge of Silver Creek near Riley, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January			10.0	615
February			20.0	1,150
March			450	27,670
April			935	55,640
May	466	60	206	12,670
June	136	14	38.7	2,303
July			54.2	3,333
August			5.8	357
September			2.6	155
October	4	2	2.3	141
November	8	2	6.2	369
December	30	6	14.4	885
The year			145	105,300

NOTE.—Discharge estimated January 1 to April 14 and July 17 to September 9, inclusive. During latter part of year gage heights estimated for missing days.

MISCELLANEOUS MEASUREMENTS IN GREAT BASIN.

The following miscellaneous measurements were made in the Great Basin in 1904:

Measurements of ditches in Reno Valley in 1904.

Date.	Hydrographer.	Ditch.	Location.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
May 21	O. Heizer	Abby	Near head-gate	2.1	16
June 6	do	do	do	2.0	18
July 8	do	do	do	1.5	8.2
July 28	do	do	do	1.9	11
Aug. 9	do	do	do	1.9	10
Aug. 23	do	do	do	1.7	5.4
Aug. 23	do	Chism	do		2.7
June 20	do	do	do	2.2	3.1
June 24	do	do	do	2.3	3.8
May 21	do	Cochron	Near V. & T. culvert	2.8	36
June 2	do	do	do	2.7	32
June 29	do	do	do	2.5	24
Aug. 23	do	do	do	2.7	22
Aug. 23	do	Colombo	Near asylum		5.1
Aug. 23	do	do	do		4.7
July 7	do	do	do	2.3	3.1
July 27	do	do	do	2.4	3.9
Aug. 22	do	do	do	1.9	1.4
Aug. 22	do	Countryman	Near head-gate		2.6
June 20	do	do	do	2.6	2.1
June 28	do	do	do	3.0	3.9
June 28	do	English Mill	Chestnut street		18
June 21	do	do	do	1.7	19
July 7	do	do	do	1.3	12
July 20	do	do	do	1.8	18
Aug. 13	do	do	do	1.7	17
May 19	do	Frey or Indian	Flume near head-gate	1.4	23
May 31	do	do	do	1.4	17
June 20	do	do	do	1.0	12
July 12	do	do	do	.8	8.1
Aug. 3	do	do	do	1.0	11
Aug. 16	do	do	do	1.4	14
	do	Glendale	Near source		12
May 30	do	do	do	2.7	12
June 9	do	do	do	2.7	12
June 13	do	do	do	3	19

Measurements of ditches in Reno Valley in 1904—Continued.

Date.	Hydrographer.	Ditch.	Location.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
June 21	O. Heizer	Glendale	Near source	2.7	20
June 28	do	do	do	3.0	12
July 27	do	do	do	2.9	12
Aug. 3	do	do	do	3.0	19
June 10	do	Highland	West of cemetery	1.6	27
July 12	do	do	do	1.7	27
July 18	do	do	do	1.7	26
Aug. 11	do	do	do	1.8	25
May 30	do	Holcomb	Near Mayberry bridge	2.6	47
June 24	do	do	do	2.6	40
July 7	do	do	do	2.4	35
July 12	do	do	do	2.4	38
May 19	do	Lake	Near head-gate	2.4	39
May 31	do	do	do	2.3	38
July 12	do	do	do	2.2	33
Aug. 5	do	do	do	2.5	38
Aug. 15	do	do	do	2.7	41
June 22	do	Merrill	do	2.0	19
July 8	do	do	do	1.8	15
July 28	do	do	do	1.9	15
Aug. 4	do	do	do	1.6	12
Aug. 29	do	do	do	1.3	8.0
Aug. 29	do	Mitchell & Carmac	do	.....	11
Aug. 29	do	do	do	.....	18
May 30	do	do	do	2.6	17
June 17	do	do	do	2.6	13
July 9	do	do	do	3.2	16
Aug. 3	do	do	do	3.2	12
May 23	do	North Truckee irrigation.	Asylum road	2.2	37
May 30	do	do	do	2.0	38
June 10	do	do	do	2.1	37
June 20	do	do	do	1.6	23
Aug. 2	do	do	do	2.4	20
May 21	do	Orr	Flume near old seminary.	2.0	60
July 7	do	do	do	1.5	41
July 20	do	do	do	2.4	70
Aug. 10	do	do	do	2.2	69
May 21	do	Pioneer	Near head-gate	2.6	25
June 9	do	do	do	3.0	32

Measurements of ditches in Reno Valley in 1904—Continued.

Date.	Hydrographer.	Ditch.	Location.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
June 23	O. Heizer	Pioneer	Near headgate	3.2	45
July 7	do	do	do	2.0	15
July 13	do	do	do	2.0	15
July 25	do	do	do	2.5	25
Aug. 5	do	do	do	2.8	23
Aug. 8	do	do	do	2.1	8.8
May 21	do	Scott ranch	Near county hospital	1.8	37
June 1	do	do	do	1.6	34
June 15	do	do	do	2.0	41
July 21	do	do	do	1.6	28
Aug. 8	do	do	do	1.7	30
Aug. 8	do	Sessions	Near headgate		3.6
June 2	do	do	do	1.8	1.5
June 10	do	do	do	2.2	4.4
June 20	do	do	do	1.6	.6
Aug. 2	do	do	do	2.2	2.4
June 16	do	Steamboat	Above Wiley's, Verdi	2.8	57
June 22	do	do	do	2.8	59
July 8	do	do	do	2.8	57
July 28	do	do	do	2.8	56
Aug. 4	do	do	do	2.8	56
Aug. 29	do	do	do	2.8	56
Aug. 29	do	Sullivan	Reno, Spark's road		47
July 7	do	do	do	2.2	26
Aug. 8	do	do	do	2.6	38
May 31	do	Wheeler	Near headgate	2.0	47
July 12	do	do	do	1.9	42
Aug. 5	do	do	do	2.1	43
Aug. 13	do	do	do	2.3	43
June 1	do	Wilson	Flume, near Glendale ditch.	2.2	3.4
June 6	do	do	do	2.1	2.7
July 18	do	do	do	2.3	3.6
Aug. 15	do	do	do	2.4	3.7
June 2	do	Mayberry & Carr	Near headgate		1.6
July 28	do	do	do		2.1
Aug. 29	do	do	do		1.5
June 2	do	Hunter Creek	Above diversions		3.5
June 22	do	do	do		3.0
June 2	do	Mayberry, north side.	Near headgate		1.3

Measurements of ditches in Reno Valley in 1904—Continued.

Date.	Hydrographer.	Ditch.	Location.	Gage height.	Discharge.
					Sec.-ft.
June 16	O. Heizer	Hogan	Near headgate		8.9
Aug. 29	do	do	do		5.7
July 28	do	do	do		9.4
July 8	do	Katz	do		9.5
July 28	do	do	do		11
Aug. 29	do	do	do		8.0

Miscellaneous stream measurements in Carson River basin, Nevada and California, in 1904.

Date.	Hydrographer.	Stream.	Location.	Discharge.
		CALIFORNIA.		*Sec.-ft.*
Aug. 31	J. T. Shaw	Bruns	Mouth of canyon	7.9
Aug. 31	do	Fairview	do	4.6
		NEVADA.		
Aug. 31	J. T. Shaw	Heitmans Springs	Mouth of canyon	1.2
Aug. 31	do	Garaveti No. 1	do	4.2
Aug. 31	do	Garaveti No. 2	do	1.0
Aug. 31	do	Monfrena Spring	do	1.2
Aug. 31	do	Scossa Creek	do	2.0
Sept. 1	do	Palmer Creek	do	3.1
Sept. 1	do	Sheridan Creek	do	3.6
Sept. 1	do	Parks Creek	do	3.4
Sept. 1	do	Motts Creek	do	3.3
Sept. 1	do	Kingsbury Creek	do	2.3
Sept. 1	do	Genoa Creek	do	1.7
Sept. 1	do	Sierra or Dressler	do	2.3
Sept. 1	do	James Canyon	do	1.4
Sept. 1	do	Jacks Valley	do	1.8
Sept. 1	do	Clear Creek	do	3.2
Sept. 3	do	Kings Canyon	do	5.4
Sept. 5	do	Ash Canyon	do	6.2

Miscellaneous stream measurements in Antelope Valley in 1904.

Date.	Hydrographer.	Creek or ditch.	Location.	Discharge.
				Sec.-ft.
Sept. 8	J. T. Shaw	Little Antelope Creek	Mouth of canyon	2.1
Sept. 8	do	Lost and Mill Canyon	do	5.2
Sept. 9	do	Shields Creek	do	3.8
Sept. 9	do	Hardy ditch	Near Headgate	5.5
Sept. 9	do	Goodknow ditch	do	9.3
Sept. 9	do	Chichester ditch No. 1	do	4.9
Sept. 9	do	Coleville ditch	do	3.8
Sept. 9	do	Alkali ditch	do	3.3
Sept. 9	do	Swager ditch	do	24
Sept. 10	do	Salmon or Carney ditch	do	4.9
Sept. 10	do	Barnett and Love ditch	do	32
Sept. 10	do	Eggleston ditch	do	14
Sept. 10	do	Gullickson ditch	do	5.9
Sept. 10	do	West Walker ditch	do	33
Sept. 10	do	Eggleston ditch	do	10
Sept. 10	do	Goodknow and Harney ditch	do	1.0
Sept. 10	do	Terry ditch	do	9.6
Sept. 10	do	Taylor ditch	do	22
Sept. 11	do	West Walker River	Hoy's bridge	41

Miscellaneous measurements of creeks in Truckee River basin, Nevada, in 1904.

Date.	Hydrographer.	Creek.	Location.	Discharge.
				Sec.-feet.
Sept. 19	J. T. Shaw	Simmonds	Mouth of canyon	1.1
Sept. 19	do	Musgrove	do	1.9
Sept. 19	do	Lewers	Lewer's ranch	.3
Sept. 19	do	do	do	.1
Sept. 19	do	Browns	Mouth of canyon	2.1
Sept. 20	do	Franktown	do	3.5
Sept. 20	do	Ophir	do	6.0
Sept. 20	do	Steamboat	do	.6

Miscellaneous measurements in Utah Lake basin in 1904.

[By C. Tanner, W. G. Swendsen, and H. S. Kleinschmidt.]

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. feet.*	*Ft. per second.*	*Feet.*	*Sec.-feet.*
Feb. 2	Peteetneet Creek	Payson	7	4.7	1.08		5
Feb. 2	do	At rating flume	3.5	1.5	1.44		2
May 17	do	In canyon	18	22	3.54	1.03	77
May 17	do	do	18	29	3.95	1.40	115
Sept. 16	do	Payson	10	5.0	1.54		8
Apr. 19	Payson slough	Near mouth	16	14	.93		13
May 16	do	do	10	13	.61		8
Dec. 22	do	do	12	7.6	.91		7
July 26	Provo Bench canal	Below mouth of canyon	16	26	2.63		67
July 26	Tanner's race	Provo, Utah	8	6.0	2.50		15
Sept. 17	Discharge of Salem pond.	Salem, Utah					3
May 26	Lake Shore canal	Lake Shore, Utah	10	32	2.34		75
May 27	Mill race	Spanish Fork, Utah	13	29	3.69		108
May 27	Canal	do	7	9.0	2.79		25
May 27	Bench canal	Near mouth of canyon	7	24	4.37		106
May 27	Salem canal	do	12	21	1.64		34
May 27	New Survey canal	do	8	19	3.19		59
May 27	Mill race waste	Below Spanish Fork City.	13	13	1.77		23
Sept. 16	Spring Lake	Spring Lake, Utah	5	2.8	.61		2
July 26	West Union canal	Near Provo, Utah	12	11	3.39	.85	37
Apr. 3	Daniels Creek	Daniels canyon					6
May 17	Santaquin Creek	Santaquin, Utah	11	15	4.69		70
Sept. 16	do	do	10	5.6	1.71		10
Dec. 20	Provo River	Above Telluride Power Co.'s intake dam.	63	128	1.93		248
Jan. 19 to Jan. 23	Utah Lake seepage[a]	41 streams					205
May 14 to May 15	do	44 streams					325
May 31	do	25 streams					361
June 18 to June 23	do	26 streams					172
Aug. 1 to Aug. 2	do	25 streams					125
Oct. 15	do	do					175
Dec. 3 to Dec. 5	do	do					172

[a] This includes all measured inflow excepting Provo River and Spanish Fork River.

Estimated monthly discharge of all measured streams flowing into Utah Lake near shore of lake, Utah, for 1904.

Month.	Total in acre-feet.	Month.	Total in acre-feet.
January	24,470	August	8,141
February	32,770	September	9,174
March	37,820	October	12,300
April	48,470	November	15,230
May	88,160	December	21,490
June	52,490		
July	8,718	The year	359,200

NOTE.—The above table includes all measurable streams of any character flowing into Utah Lake.

Miscellaneous measurements in Bear River basin in 1904.

[By C. Tanner, W. G. Swendsen, and H. S. Kleinschmidt.]

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. feet.*	*Ft. per second.*	*Feet.*	*Sec.-feet.*
Nov. 7	North Branch of St. Charles Creek.	One-fourth mile east of road.	16	8.8	1.59	.....	14
May 6	Fish Haven Creek No. 5.	Fishhaven, Idaho	9	10	2.72	.....	27
June 10	.....do	.....do	9	15	2.77	.....	41
Nov. 8	.....do	.....do	12	5.2	1.23	.....	6
Dec. 21	.....do	.....do	12	7.1	1.37	.....	10
May 6	Swan Creek No. 6	3 miles south of Fishhaven on county road.	13	32	3.93	.....	126
June 10	.....do	.....do	13	38	4.63	.....	178
June 29	.....do	.....do	13	34	2.48	.....	84
Nov. 8	.....do	At lake	25	24	1.82	.....	43
Dec. 21	.....do	On county road	18	30	1.44	.....	43
May 6	Laketown Creek (weir) Nos. 7–9.	Near Laketown	16	.....	.....	.....	50
Nov. 8	Spring Creek	Laketown, Idaho	10	11	.96	.....	10
May 7	North Eden Creek No. 11.	North Eden, Idaho	4.5	3.8	1.90	.....	7
May 8	Stephen's slough	Dingle, Idaho	15	60	2.76	.....	166
July 7	Power canal left side Bear River.	Bear River Canyon	21	84	1.87	.....	157
June 4	Logan and Hyde Park canal.	Logan, Utah	10	19	3.72	5.1	72
July 3	.....do	.....do	10	23	3.24	5.5	74
Dec. 17	.....do	.....do	9.0	14	.72	.....	10
Nov. 7	Bear Lake outlet, flowing into Bear Lake this date.	Bridge on turnpike	38	152	.26	.....	40
May 5	Ovid Creek No. 1	Ovid, Idaho	65	185	1.95	.....	362
June 9	.....do	.....do	58	73	2.13	.....	157
June 28	.....do	.....do	12	39	.61	.....	24
Dec. 21	.....do	.....do	10	9.0	1.16	.....	10
May 5	Paris Creek No. 2	Paris, Idaho	25	23	2.42	.....	1
June 10	.....do	.....do	28	41	2.55	.....	106
June 30	.....do	.....do	20	20	1.12	.....	23

Miscellaneous measurements in Bear River basin in 1904—Continued.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Discharge.
			Feet.	*Sq. feet.*	*Ft. per second.*	*Sec.-feet*
Nov. 8	Paris Creek No. 2	Paris, Idaho	25	18	.96	17
Dec. 21	do	do	42	24	1.24	28
May 5	Bloomington Creek No. 3	Bloomington, Idaho	22	22	2.50	54
June 10	do	do	12	17	2.79	47
June 28	do	do	30	24	2.16	52
Nov. 8	do	do	16	14	2.31	33
Dec. 21	do	do	18	12	1.74	22
May 5		3 creeks between Bloomington and St. Charles.				54
May 5	St. Charles Creek No. 4	St. Charles, Idaho	41	62	2.31	142
June 10	do	do	43	66	3.35	222
June 29	do	do	44	62	1.77	111
Nov. 8	do	do	18	9.6	1.77	17
Dec. 21	do	do	22	21	1.33	28

Miscellaneous measurements in Jordan River basin in 1904.

[By Caleb Tanner.]

Date.	Stream.	Locality.	Width.	Area of section	Mean velocity.	Discharge.
			Feet.	*Sq. feet.*	*Ft. per second.*	*Sec.-feet.*
Dec. 7	Jordan River	Hub dairy, Salt Lake City, Utah.	54	125	1.53	190
Dec. 7	do	Above Little Cottonwood Creek.	40	51	1.21	61
Dec. 7	do	Near sewer farm	103	203	1.05	214
Dec. 6	Big Cottonwood Creek	One-fourth mile above mouth.	26	28	1.83	51
Dec. 6	Decker Lake outlet	At Redwood road crossing.	5.5	3.6	.82	3
Dec. 7	Hot Spring Lake outlet	North of Salt Lake City, Utah.	17	8.2	.93	8
Dec. 6	Little Cottonwood Creek	Near mouth	12	6.9	1.18	8
Dec. 6	Mill Creek	do	8.5	9.1	2.62	24
Dec. 6	North Branch of Parleys Creek	do	6.0	3.0	.86	3
Dec. 6	South Branch of Parleys Creek	do	8.0	4.3	1.44	6
Dec. 6	Taylorsville roller mill flume	Opposite Little Cottonwood Creek.	6.8	23	1.70	39

Miscellaneous measurements in Duchesne River basin in 1904.

[By C. Tanner and F. Thomas.]

Date.	Stream.	Locality.	Width.	Area of section	Mean velocity.	Discharge.
			Feet.	*Sq. feet.*	*Ft. per second.*	*Sec.-ft.*
Oct. 6	Spring Branch	Tributary from left North Fork Duchesne, just above gaging station.	11	8.4	1.25	10
Oct. 6	do	Tributary North Fork Duchesne from right, just above cable station.				9.0
Oct. 7	Hades Creek	Tributary North Fork Duchesne.	6	4.3	1.43	6.2
Oct. 7	Mountain stream	Tributary North Fork Duchesne, 1 mile below Hades Creek.				1.5
Oct. 7	North Fork Duchesne	Reconnaissance survey crossing.	33	30	.80	24
Oct. 8	West Fork Duchesne	do	14	12	1.17	14
Oct. 8	Nos. 1, 2, 3, and 4	Tributaries West Fork Duchesne, between reconnaissance survey crossing and cable station.				3
Oct. 12	Mud Creek	At upper contour, State reservoir survey, Strawberry Valley.	3	.8	.82	.6
Oct. 12	Strawberry River	do	16	9.7	.98	9.7
Oct. 12	Spring Branch	do	(a)	(a)	(a)	.2
Oct. 12	do	do	.8	.28	1.00	.3
Oct. 12	Trout Creek	do	2.0	1.6	1.19	3.4
Oct. 12	Springs	At upper contour, State reservoir survey, Strawberry Valley, between Trout Creek and Coal Canyon.				a.5
Oct. 12	Bryants Fork	At upper contour, State reservoir survey, Strawberry Valley.	5.5	4.7	.64	3.0
Oct. 12	Indian Creek	do	9	5.9	2.25	13
May 26	Wolf Creek	Tributary West Fork Duchesne.	12	9.5	3.35	32
June 16	do	do	12	9.4	2.66	25
June 26	do	do	11	8.0	2.33	19
July 18	do	do	10	6.1	1.86	12
Aug. 16	do	do	10	5.2	2.10	11
Oct. 8	do	do	9.5	4.9	1.56	8
Apr. 5	Duchesne River	Twelve miles below forks.	60	66	1.28	85
Apr. 5	Red Creek	Four miles above junction of Currant and Red creeks.	10	5	1.25	6
Apr. 6	West Fork Duchesne	At forks	18	21	1.02	21
Apr. 6	North Fork Duchesne	do	32	33	1.39	46
Apr. 7	Rock Creek	At junction with Duchesne River.	36	42	1.10	46
Apr. 8	Lake Fork	Eight miles above junction with Duchesne.	34	43	1.77	77
Apr. 9	Strawberry River	At Starvation	46	44	2.37	104
Apr. 9	do	Above Red Creek	32	37	1.45	54
Sept. 2	East Fork of Lake Fork	Eight miles above forks of Lake Fork.	41	52	2.26	116

a Estimated.

Miscellaneous measurements in Duchesne River basin in 1904—Continued.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Discharge.
			Feet.	*Sq. feet.*	*Ft. per second.*	*Sec.-feet.*
Sept. 24	Water Hollow	Tributary Currant Creek.	5.5	2.5	1.34	3.4
Sept. 24	Little Red Creek	do	3	1.2	1.10	1.3
Sept. 24	do	Currant Creek (from right, 5¼ miles above gaging station at road crossing).	3.5	1.2	1.50	1.9
Sept. 29	Creek Nos. 1–2	Tributary West Fork of Lake Fork.				[a] .3
Oct. 4	Rock Creek	At Reconnaissance Survey crossing.		22	1.39	31
Oct. 4	Big Spring	Tributary Rock Creek one-eighth mile below Reconnaissance Survey crossing.	7	4.2	1.75	7.4
Oct. 4	Nos. 1–8	Tributary Rock Creek between big spring and cable station.				[a] 2.1
Oct. 4	Tawanta Creek	Tributary Rock Creek one-eighth mile below gaging station.				[a] .5

[a] Estimated.

Miscellaneous measurements in Weber and Malad River basins in 1904.

[By W. D. Beers.]

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Discharge.
			Feet.	*Sq. feet.*	*Ft. per sec.*	*Sec.-feet.*
Dec. 14	Lost Creek	Near Croydon, Utah	17	10	0.81	8
Dec. 14	do	Near junction with Weber River.	29	28	.94	26
Dec. 14	Weber River	At Devils Slide	90	96	1.77	170
Dec. 15	do	Devils Gate	90	107	2.07	222
May 11	Malad River	At Riverside, Utah	23	52	1.06	56

Miscellaneous measurements in Sevier River basin in 1904.

[By C. Tanner.]

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-f.*
Mar. 4	Sevier River	Sevier Bridge, Utah	49	78	0.99	0.91	77
Mar. 21	do	do	20	20	2.40	.55	47
Aug. 20	do	do	20	22	2.10		46
Oct. 26	do	do	20	23	2.26		52

Miscellaneous measurements in Willow Creek basin, California, in 1904.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
1904.				*Second-feet.*
January 7	J. S. Evans	Willow Creek	Susanville	11.6
May 12	James Branham	do	do	9
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PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 133.]

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists may be had on application.

Most of the above publications may be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they may be obtained, free of charge (except classes 2, 7, and 8), on application.

2. A certain number are allotted every member of Congress, from whom they may be obtained, free of charge, on application.

3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they may be had at practically cost.

4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they may be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements. A detailed index of these reports (1888–1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II.
1889. Eleventh Annual Report, Part II.
1890. Twelfth Annual Report, Part II.
1891. Thirteenth Annual Report, Part III.
1892. Fourteenth Annual Report, Part II.
1893. Bulletin No. 131.
1894. Bulletin No. 131; Sixteenth Annual Report, Part II.
1895. Bulletin No. 140.
1896. Water-Supply Paper No. 11; Eighteenth Annual Report, Part IV.
1897. Water-Supply Papers Nos. 15 and 16; Nineteenth Annual Report, Part IV.
1898. Water-Supply Papers Nos. 27 and 28; Twentieth Annual Report, Part IV.
1899. Water-Supply Papers Nos. 35, 36, 37, 38, and 39; Twenty-first Annual Report, Part IV.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65 and 75.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75.
1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.

1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.

The Geological Survey and the Reclamation Service have suboffices in different parts of the United States, from which hydrographic and reclamation work in the respective localities is carried on and where data may be obtained on application. These offices are located as follows:

Boston, Mass., 6 Beacon street; Utica, N. Y., 75 Arcade; Atlanta, Ga., 409 Temple court; Austin, Tex., University of Texas; Chicago, Ill., Federal Building; Belle Fourche, S. Dak.; Cody, Wyo.; Denver, Colo., Chamber of Commerce Building; Salt Lake, Utah; Los Angeles, Cal., 1108 Braly Building; San Francisco, Cal., 422 Merchants' Exchange Building; Phoenix, Ariz.; Carlsbad, N. Mex.; El Paso, Tex.; Billings, Mont.; Great Falls, Mont.; Hazen, Nev.; Boise, Idaho; Spokane, Wash., 424 Peyton Block; Pendleton, Oreg.

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CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1904

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

BY

W. B. CLAPP

PART XI.—The Great Basin and Pacific Ocean Drainage in California.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1905

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
HYDROGRAPHIC BRANCH,
Washington, D. C., April 15, 1905.

SIR: I transmit herewith the manuscript of Part XI of a series of twelve papers which compose the Report of Progress of Stream Measurements for the Calendar Year 1904. Parts I to VI of this report contain the results of the data collected in the territory east of Mississippi River. Parts VII to XII are devoted to the data collected in the territory west of Mississippi River.

The original data for this report were collected in cooperation with the State of California under the direction of J. B. Lippincott, supervising engineer for that State. The field operations were under the immediate direction of W. B. Clapp. The assembling of the data and their preparation for publication were done under the direction of Mr. Clapp. The original manuscript contained all the data collected in California during 1903 and 1904. As the 1903 data were published in Water-Supply Paper No. 100, they have, with a few exceptions, been omitted from this report.

I request that this manuscript be published as one of the series of Water-Supply and Irrigation Papers.

Very respectfully,

F. H. NEWELL,
Chief Engineer.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1904.

PART XI.

By W. B. Clapp.

INTRODUCTION.

The hydrographic work of the United States Geological Survey includes the collection of facts concerning and the study of conditions affecting the behavior of water from the time it reaches the earth as rain or snow until it joins the oceans or great navigable rivers. These investigations became a distinct feature of the work of the Survey in the fall of 1888, when an instruction camp was established at Embudo, N. Mex. Since that date the work has been continually and gradually extended as larger funds became available. The first distinctive appropriation for gaging streams was made by the act of August 18, 1894, which contained an item of $12,500, "for gaging the streams and determining the water supply of the United States, including the investigation of underground currents and artesian wells in the arid and semiarid sections." (Digest of Appropriations for 1895, p. 270.)

Since that time a similar act has been passed each year and the appropriations have gradually increased, as shown in the following table:

Annual appropriations for hydrographic surveys.

Year ending June 30, 1895	$12,500
Year ending June 30, 1896	25,000
Year ending June 30, 1897	50,000
Year ending June 30, 1898	50,000
Year ending June 30, 1899	50,000
Year ending June 30, 1900	50,000
Year ending June 30, 1901	100,000
Year ending June 30, 1902	100,000
Year ending June 30, 1903	200,000
Year ending June 30, 1904	200,000
Year ending June 30, 1905	200,000
Year ending June 30, 1906	200,000

The chief feature of the work of the hydrographic division is the systematic study of the flow of the surface waters and the conditions affecting the same. In this connection other information that may be of use to the engineer or others in hydrographic studies, such as river profiles, duration and extent of damage by floods, water-power data, etc., is collected. Furthermore, the work has been so directed that the information collected will be of direct value in the commercial and agricultural development of the country.

As a result of the increased appropriations since June 30, 1902, the work has been largely extended and thoroughly systemized. The various States have been grouped into districts, each of which is under the supervision of a district hydrographer who, with a corps of assistants, devotes his whole time to the study of the hydrographic resources of his district.

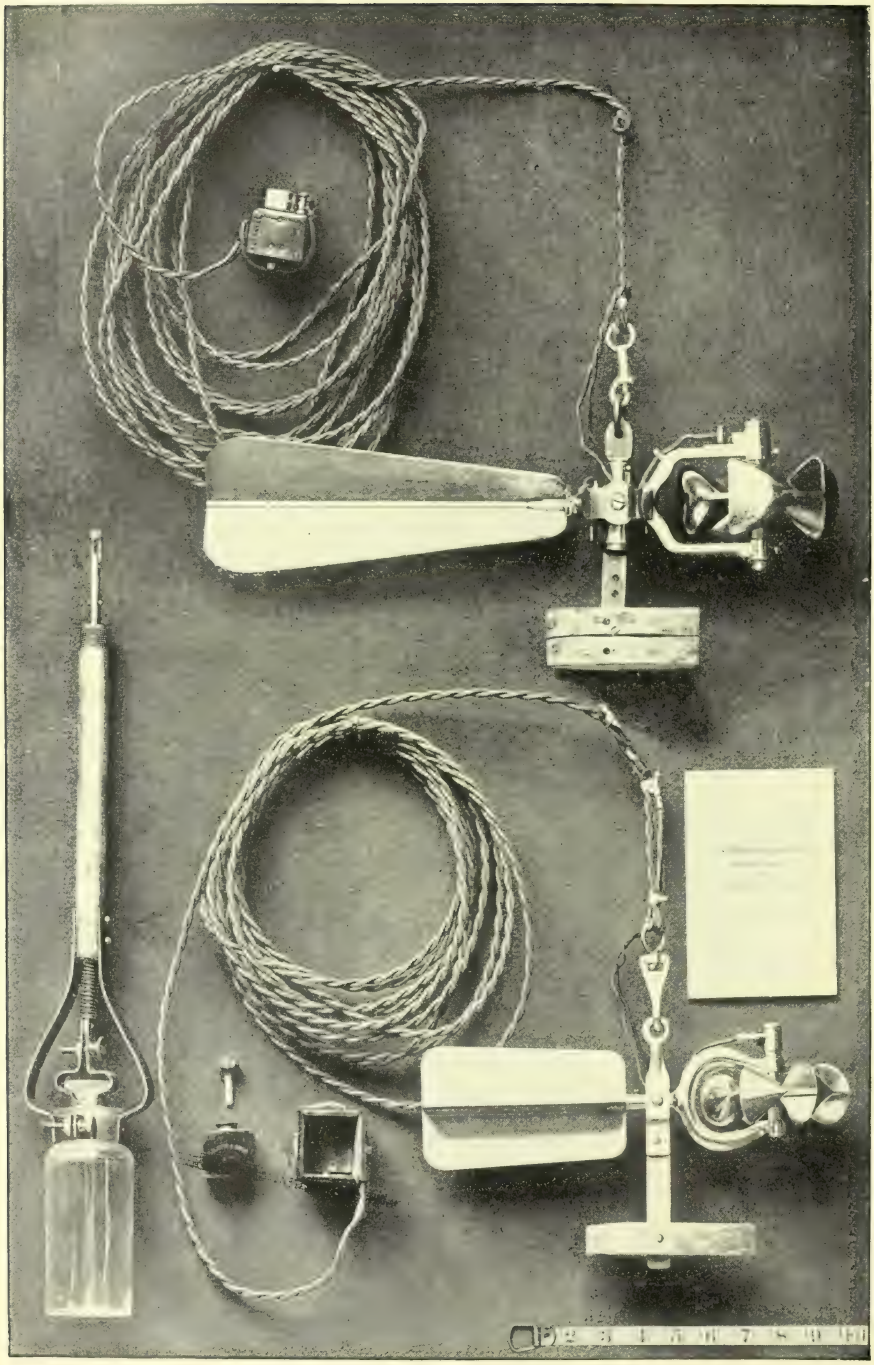
The methods used in the collection of these data and in their preparation for publication are given in detail in Water-Supply Paper No. 94. (Hydrographic Manual, U. S. Geol. Survey.)

The general plan of stream gaging which has been developed is to obtain eventually data in regard to the flow of all the important streams in the United States. With this in view gaging stations are established at points where the data will be of greatest commercial value. At these stations discharge measurements are taken from time to time at typical river stages, and the daily surface fluctuation is obtained by means of gage readings. From these two factors it is possible to estimate both the total flow and its distribution through the period of observation.

The selection of the site for a gaging station and the length of time the station is maintained depend largely upon the needs of each locality. If the stream is to be used for water power, special efforts are made to obtain information concerning the low-water flow. If water is to be stored, the high waters are given special attention. In all sections certain permanent stations are maintained for general statistical purposes to show the conditions which exist through long periods. They also act as primary stations, and are used in connection with short series of measurements to determine the flow in particular portions of the drainage basin.

Gaging stations are divided into two general classes: First, current-meter stations, and, second, weir stations. The former class is subdivided as to location into bridge, cable, boat, and wading stations. Fig. 1 shows a cable station with car, tag line, inclined gage, etc. In addition to the bridge, cable, or boat, the equipment of a current-meter gaging station consists in a gage for determining the daily fluctuations of the water surface, bench marks to which the zero of the gage is referred, and permanent marks on the bridge or a tagged line indicating the points of measurement. Where the current is swift

MAP OF THE UNITED STATES, SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1904.



PRICE CURRENT METERS, WITH BUZZERS.

some appliance, generally a secondary cable, is necessary to hold the meter below the surface.

Gaging stations are generally located at bridges, if the channel conditions are satisfactory, as from them the meter can be easily manipulated, and the cost of the equipment is comparatively small. The stations are located as far as possible at points where the channel is straight, both above and below the gaging section, and where there are no cross currents, backwater, or boils. The bed of the stream should be as clear as possible from large projections and of a permanent character. The banks should be high, and should overflow at high stages only. At stations with shifting beds more measurements are made, and special methods of computing daily discharges are employed. Great care is taken in the selection and equipment of gaging stations in order that the data may have the required degree of accuracy.

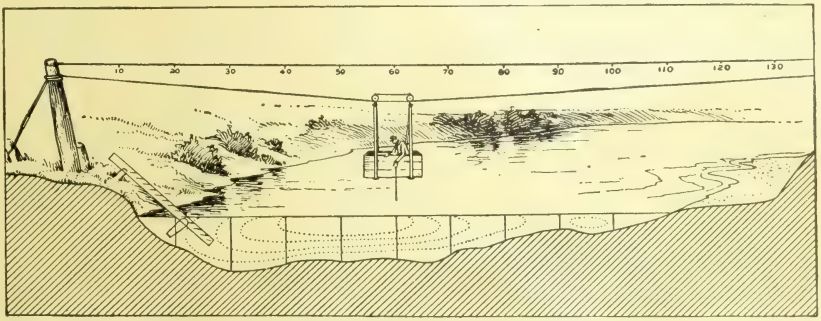


FIG. 1.—Cable station, showing section of river, car, gage, etc.

On many of the larger rivers, where water power is developed by dams, estimates of flow are obtained by observing the head on the crest and using a weir formula. On the smaller streams sharp-crested weirs are in some cases erected.

The principal instrument used in stream-measurement work is the current meter, by which the velocity of the flow of water is determined. After years of experience the Survey has adopted the Price current meter for general work. This meter, as is shown on Pl. II, is made in two sizes, known as the large and small Price. The small Price has been largely developed by the officers of the Survey, using the Price acoustic meter as a basis.

A discharge measurement is the determination of the quantity of water flowing past a certain point at a given time. This quantity is the product of two factors: (1) The mean velocity, which is the function of the cross section, surface slope, wetted perimeter, and roughness of bed; (2) the area, which depends upon the permanency of the bed and the fluctuations of the surface, which govern the depth.

In making the measurement an arbitrary number of points are laid off perpendicular to the thread of the stream (see fig. 1). These points are usually at regular intervals varying from 2 to 20 feet, depending upon the size and conditions of the stream. They are known as measuring points, and at them the observed data, the velocities and soundings, are taken. The perpendiculars dropped from the measuring points divide the gaging section into strips, and for each strip or pair of strips the mean velocity, area, and discharge are determined independently; thus conditions existing in one part of the stream are not distributed to parts where they do not apply.

The methods of obtaining velocity with the current meters which are in general use may be grouped into three classes: Single point, multiple point, and integration.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined. Extensive experiments by vertical velocity-curves show that the thread of mean velocity lies at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and it is at this depth that the meter is held in the majority of the measurements, this being known as the six-tenth depth method. It is found by a large number of vertical velocity-curve measurements, taken on various streams and under various conditions, that the coefficient for reducing the velocity obtained at six-tenths depth to mean velocity is practically unity, ranging, in a series of 910 measurements made at 39 gaging stations, between .94 and 1.04, with a mean for the 910 observations of 1.00. In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the action of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocities taken at the subsurface has been found by repeated experiments with vertical velocity-curves to be from .85 to .95, depending upon the depth of the stream and velocity and channel conditions. This method is specially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The three principal multiple-point methods in general use are: The vertical velocity-curve; top and bottom; and top, bottom, and mid depth. In the vertical velocity-curve method a series of velocity determinations are taken in the vertical at regular intervals, usually from 0.5 to 1 foot apart. By platting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve through these points, the vertical velocity-curve is produced, which shows the change in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the depth

into the area bounded by this mean velocity-curve and the initial line. Owing to the length of time it takes to make these measurements they are seldom used except for determining coefficients for purposes of comparison and for measurements under ice.

In the second multiple-point method the meter is held from 0.5 to 1 foot below the surface and about 0.5 foot above the bottom, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. This method is not well adapted for general work, as the roughness of the bottom disturbs the velocity at that point. For shallow streams with comparatively smooth beds good results are obtained by this method. In the third multiple-point method the meter is held at mid depth, 0.5 foot below the surface, and 0.5 foot above the bottom, and the mean velocity is determined by dividing the sum of the top velocity, twice the mid-depth velocity, and the bottom velocity by 4.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface. The number of revolutions and the time taken in the operation is noted, and the mean velocity is found by dividing the number of revolutions by the number of seconds taken in the run. This method has the advantage, in that the velocity at each point of the vertical is measured twice. It is well adapted for measurements under ice and as a check on the point methods.

The area, which is the other factor for determining the discharge of the stream, depends upon the stage of the river, which is taken on a gage, and the general contour of the bed of the stream, which is found by sounding. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For stations with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also used for obtaining the area for use in high-water measurement computations, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at the various points of measurements the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or double strip. The total discharge and area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The volume of water flowing in a stream is known as run-off. In expressing it various units are used, depending upon the kind of work for which the data are needed. Those used in this report are "second-

feet," "acre-feet," "run-off per square mile," and "run-off in depth in inches," and may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second, and is the body of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second.

The "acre-foot" is the unit of capacity used in connection with storage for irrigation work, and is equivalent to 43,560 cubic feet. It is the quantity required to cover an acre to a depth of 1 foot. There is a convenient relation between the second-foot and the acre-foot; 1 second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, which equals 1.9835 acre-feet, or, approximately, 2 acre-feet.

The expression "second-feet per square mile" means the average number of cubic feet of water flowing each second from every square mile of drainage area on the assumption that the run-off is uniformly distributed.

"Depth in inches" means the depth of water in inches that would have covered the drainage area, uniformly distributed, if all the water could have accumulated on the surface. This quantity is used for comparing run-off with rainfall, which quantity is usually given in depth in inches.

It should be noticed that "acre-feet" and "depth in inches" represent the actual quantities of water which are produced during the periods in question, while "second-feet," on the contrary, is merely a rate of flow per second.

The base data for computing the daily discharge of a stream are the daily gage heights and the various discharge measurements, of which there should be sufficient number to cover the range of stage. The fundamental laws upon which these computations are based are the following:

(1) The discharge will remain constant so long as the conditions at or near the gaging station remain constant;

(2) Neglecting the change of slope due to the rise and fall of the stream, the discharge will be the same whenever the stream is at a given stage; and

(3) The discharge is both a function of, and increases gradually with, the gage heights. (2 and 3 depend on 1.)

As the beds of many streams are changeable, the problem divides itself into two classes: (1) Those of streams with permanent, or practically permanent, beds, and (2) those of streams with changeable beds. The base data and methods of obtaining them are the same for either class, and it is only in the computation of the mean daily flow that different methods are necessary.

In determining the daily discharge of streams with permanent beds the results of the discharge measurements are plotted on cross-section paper, with gage heights as ordinates and discharges as abscissas.

Through these points a smooth curve is drawn, which shows the discharge for any gage height, and from which a rating table is prepared. Aside from plotting the discharge, the mean velocity and area determined for each discharge measurement are plotted. Through these points the curves of mean velocity and of area are drawn, and the rating curve is largely determined by taking the product of the mean velocity and the area at various stages as determined by these curves. These curves of mean velocity and area are of special value to determine the location of the rating curve for stages at which actual discharge measurements are not available and for extending the discharge curve outside the limits of the measurements. In the preparation of the rating table the discharge for each tenth or half tenth on the gage is found from the curve. The first and second differences of these discharges are then taken and adjusted according to the law that they shall either be constant or increasing, never decreasing. The discharges in the table are then changed in accordance with these adjusted differences. In making up the station-rating curve the individual discharge measurements and the conditions under which they were taken are carefully studied in order that proper weight shall be given to each measurement. Rating curves in general take the form of a parabola, and as a rule the high-water portion of the curve approaches a straight line. For stations of permanent character the results of the measurements from year to year should be within 5 per cent of the curve, with the exception of those taken during high water, when the probable error may be as high as 10 per cent.

The determination of the daily discharge of streams with changeable beds is difficult, and unless frequent discharge measurements are made the results obtained are only roughly approximate. For streams with continually shifting beds, such as Colorado River and the Rio Grande, discharge measurements are made every two or three days, and the discharges for the intervening days are obtained by interpolation, modified by the gage heights for these days. For stations with beds which shift slowly, or are only materially changed during floods, station-rating curves and tables can be prepared for the periods between changes, and satisfactory results can be obtained with two or three measurements a month, providing measurements are taken soon after the changes take place.

In determining the flow for periods when the streams are frozen, special rating curves and tables have to be prepared from measurements taken under these conditions. The methods of constructing these curves and tables are the same as for open sections. The discharge measurements, however, are either taken by integration in verticals or by the vertical velocity-curve method, as sufficient experiments have not been made on ice-covered streams to determine the laws which govern the position of the thread of mean velocity.

The Report of Progress of Stream Measurements for the Calendar Year 1904, of which this is Part XI, is published in a series of twelve Water-Supply Papers, Nos. 124–135, inclusive, under the following subtitles:

Part 1. Atlantic coast of New England drainage.

Part 2. Hudson, Passaic, Raritan, and Delaware River drainages.

Part 3. Susquehanna, Patapsco, Potomac, James, Roanoke, Cape Fear, and Yadkin River drainages.

Part 4. Santee, Savannah, Ogeechee, Altamaha Rivers, and Eastern Gulf of Mexico drainages.

Part 5. Eastern Mississippi River drainage.

Part 6. Great Lakes and St. Lawrence River drainage.

Part 7. Hudson Bay, Minnesota, Wapsipinicon, Iowa, Des Moines, and Missouri River drainages.

Part 8. Platte, Kansas, Meramec, Arkansas, and Red River drainages.

Part 9. Western Gulf of Mexico drainage.

Part 10. Colorado River and the Great Basin drainage.

Part 11. The Great Basin and Pacific Ocean drainages in California.

Part 12. Columbia River and Puget Sound drainage.

The territory covered by each paper is given in the subtitle, and the larger drainages are, for convenience in arrangement, subdivided into smaller ones, under which the data are arranged, as far as practicable, geographically.

These papers contain the data that have been collected at the regular gaging stations, the results of the computations based upon the observations, and such other information that has been collected that has a direct bearing on these data including, as far as practicable, descriptions of the drainage areas and the streams draining them.

For each regular station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of estimated monthly and yearly discharges and run-off.

The descriptions of stations give, as far as possible, such general facts about the locality and equipment as would enable the reader to find the station and use the same. They also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year. This includes the date, the hydrographer's name, the gage height, and the discharge in second-feet. The table of daily gage heights gives for each day the mean height of the surface of the river as found from the mean of the gage readings taken on that day. At most of the stations the gage is read in the morning and in the evening.

The rating table gives discharges in second-feet corresponding to each stage of the river as given by the gage heights.

In the table of estimated run-off the column headed "Maximum" gives the mean flow for the day when the mean gage height was the highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" gives the average flow for each second during the month. Upon this mean the computations for the three remaining columns which are defined on page 14 are based.

The results of stream measurements made during previous years by the United States Geological Survey can be found in the following Survey publications. A detailed index of these reports (1888–1903) is given in Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II.
1889. Eleventh Annual Report, Part II.
1890. Twelfth Annual Report, Part II.
1891. Thirteenth Annual Report, Part III.
1892. Fourteenth Annual Report, Part II.
1893. Bulletin No. 131.
1894. Bulletin No. 131, and Sixteenth Annual Report, Part II.
1895. Bulletin No. 140, and Seventeenth Annual Report, Part II.
1896. Water-Supply Paper No. 11; Eighteenth Annual Report, Part IV.
1897. Water-Supply Papers Nos. 15 and 16; Nineteenth Annual Report, Part IV.
1898. Water-Supply Papers Nos. 27 and 28; Twentieth Annual Report, Part IV.
1899. Water-Supply Papers Nos. 35 to 39, inclusive; Twenty-first Annual Report, Part IV.
1900. Water-Supply Papers, Nos. 47 to 52, inclusive; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65 and 75. West of Mississippi River, Water-Supply Papers Nos. 66 and 75.
1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83. West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98. West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124 to 129, inclusive. West of Mississippi River, Water-Supply Papers Nos. 130 to 135, inclusive.

A limited number of these are for free distribution, and as long as the supply lasts the same may be obtained by application to the Director, United States Geological Survey. Aside from these, other copies are filed with the Superintendent of Public Documents, Washington, D. C., from whom they may be had at prices little above cost. Copies of Government publications are, as a rule, furnished to the public libraries in our large cities, where they may be consulted by those interested.

COOPERATION AND ACKNOWLEDGMENTS.

Most of the measurements presented in this paper have been obtained through local hydrographers. Acknowledgment is due to each of these persons, and thanks are extended to other persons and corporations who have assisted local hydrographers or have cooperated in any way, either by furnishing records of the height of water or by assisting in transportation.

The hydrographic work of the United States Geological Survey in California has been carried on in cooperation with the State, in accordance with an act of the State legislature approved March 16, 1903, which is in substance as follows:

> The State board of examiners are hereby empowered to enter into contracts with the Director of the United States Geological Survey for the purpose of making topographic maps, to the extent of twenty thousand dollars; also for the purpose of gaging streams, surveying reservoir sites and canal locations, for the conservation and utilization of the flood of storm waters of the State to the extent of fifteen thousand dollars, etc.

The State board of examiners is composed of the following members, viz: George C. Pardee, governor; C. F. Curry, secretary of State; U. S. Webb, attorney-general.

Although the portion of the new bill referring to hydrographic work provides for making surveys of reservoir sites and canal locations none of the State money has been expended for this purpose; the Geological Survey has made these investigations on Puta Creek, Sacramento River, Pit River and tributaries, Owens River, and Colorado River, and has paid the entire expense from its own funds.

The State appropriation, $7,500 of which became available July 1, 1903, has been used exclusively for gathering general stream-flow data; the Survey also apportioned $10,400 for the same purpose for the fiscal year beginning July 1, 1903. At this time 28 gaging stations were being maintained in California; other stations were added, and on December 31, 1904, 72 stations were being maintained. The data being accumulated for each of these stations have a specific value in connection with the future development of the resources of the State. The information will be invaluable in designing and making estimates of cost for storage, irrigation, power and drainage works, and for use in litigation.

The work in California is under the direction of Supervising Engineer J. B. Lippincott,[a] assisted by Hydrographers Samuel G. Bennett and W. B. Clapp. Acknowledgments are also due to the following individuals and corporations for assistance rendered and data furnished: To J. C. Pierson, city surveyor of Sacramento, Cal., for river stage and turbidity records of Sacramento River at Sacramento for 1904;

[a] The office of the supervising engineer is 1108 Braly Building, Los Angeles, Cal.

to the Kern County Land Company, through A. K. Warren, engineer in charge of water measurements, for the record of Kern River; to the McCloud River Power Company for river stage records during 1903 of McCloud River at Johns Camp; to the city of Santa Barbara for cooperation in gaging Santa Ynez River and Mono Creek; to the Southern Pacific Company through its chief engineer, William Hood, for river stage records of San Joaquin River at Herndon and King River at Kingsburg, Cal., and for transportation furnished the supervising engineer and assistants, and to the officials of the Santa Fe route for transportation furnished to the supervising engineer and assistants.

COLORADO RIVER DRAINAGE BASIN.

Topographically considered, this is the largest hydrographic basin lying wholly within the arid region, having a total area above the town of Yuma, Ariz., of over 225,000 square miles. It is situated in Wyoming, Utah, Colorado, Arizona, New Mexico, Nevada, and California, but the principal water supply comes from the melting snows of the high mountains of Wyoming, Utah, and Colorado. The minimum flow is less than 3,000 second-feet. The maximum reaches more than 75,000 second-feet. This stream has been called the Nile of America. Like the Nile, the Colorado is subject to an annual summer rise, which comes at a time when it is most needful for irrigation. Its waters carry a large amount of sediment, reaching as high as 2,000 parts of sediment to 100,000 parts of water. The minimum amount is carried during the winter months, and probably is never less than 60 parts of sediment to 100,000 parts of water.

Prof. R. H. Forbes, in Bulletin No. 44, University of Arizona agricultural experiment station, says:

> On the basis of the profile constructed from available data for the volume of flow of the Colorado and of the year's silt determinations made in this laboratory, it is estimated conservatively that the river during 1900 brought down about 61,000,000 tons of sedimentary material, which, condensed to the form of solid rock, is enough to cover 26.4 square miles 1 foot deep, or to make 53 square miles of dry, alluvial soil 1 foot deep, or to make about 164 square miles of recently settled, submerged mud 1 foot deep, reckoning the whole amount of mud for the year to average 6.2 times the bulk of the solid sediment.

A comparatively small amount of land is irrigated by the waters of Colorado River, owing to the fact that the main stream and both of its tributaries are situated so far below the level of the irrigable lands as to render their diversion extremely difficult or impracticable.

There are two pumping plants that lift water for irrigation at Yuma and several at other points on the river above Yuma. The Imperial canal diverts water at a point on the right bank of the river 10 miles, by river, below Yuma.

During December, 1901, and January, 1902, a reconnaissance of

Colorado River and Valley was made from The Needles and Yuma by J. B. Lippincott and others. In October, 1902, a reconnaissance was made by Mr. Lippincott, beginning at a point called Greggs Ferry, Mohave County, Ariz., and extending to The Needles, Cal.

Numerous dam and reservoir sites and diversion points for canals were discovered, together with large tracts of fertile land capable of being irrigated. In November, 1902, extensive topographic, soil, and hydrographic surveys were begun in the Colorado River Valley by the Reclamation Service of the United States Geological Survey.

The following is a list of the stations in the lower portion of Colorado River drainage basin: Colorado River at Yuma, Ariz.; Gila River at Yuma, Ariz.; Gila River at Gila City, Ariz.; Imperial canal at heading near Yuma, Ariz.; canals entering Imperial Valley; Colorado River at Bulls Head, Ariz.

COLORADO RIVER AT YUMA, ARIZ.

This station is located in the town of Yuma, Ariz., 1½ miles below the mouth of Gila River, and 10 miles, by river, above the Mexican boundary. Records of the river height have been kept by the Southern Pacific Railway Company since April 1, 1878, on the gage which was established by Arthur Brown, superintendent of the bridge and building department of the Southern Pacific Railway Company, during the summer of 1876. The lower section of the rod, reading from 10 to 22 feet, is nailed to the pile protection on the right bank of the Southern Pacific Railway bridge. The upper section, reading above 22 feet, is fastened on the lower side of the first bridge pier from the left bank. This gage height, plus 100 feet, is the Southern Pacific elevation above the sea level. At a later date the Southern Pacific Railway Company established a vertical gage rod (the old rod still remaining), fastened to the pile protection on the left bank of the river just below the railway bridge. This gage has been used continuously since it was established (date unknown) and is the one used by the United States Geological Survey at present. It corresponds in elevation to the old gage established in 1876. The gage is read twice a day by W. D. Smith, who is employed as local hydrographer for the stations in this vicinity.

Discharge measurements are made by means of a ¾-inch cable supported on masts. At low water measurements are made from a boat held in place by a cable. A car is used at flood stages. The initial point for soundings is the cable support on the south bank, about 20 feet from the water's edge at high water. The cable has a span of 650 feet. At low water the channel has a width of 325 feet. During floods a large part of the water flows through an old channel and does not pass under the cable. It is measured at the point where it passes under the railway trestle. The channel of the main river is

straight for 600 feet above and 5,000 feet below the station. The current is swift and the gaging section regular. The right bank is low, wooded, and liable to overflow. The left bank is not subject to overflow. The bed of the stream is composed of silt and sand and is very unstable. At low water a sand bar forms, which divides the channel into two parts. The bench mark is located on the first pier from the left bank. It is a standard bronze cap United States Geological Survey bench mark and has an elevation of 137 feet above sea level, as determined by the topographic branch of the Geological Survey. Its elevation above the zero of the gage is 35.31 feet.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Colorado River at Yuma, Ariz., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 2	W. D. Smith	18.92	3,981
January 5	do	18.84	4,007
January 8	do	18.75	3,677
January 11	do	18.60	3,494
January 14	do	18.55	3,418
January 16	do	18.70	3,512
January 19	do	18.60	3,407
January 21	do	18.75	3,694
January 23	do	18.75	3,586
January 26	do	18.70	3,511
January 28	do	18.75	3,595
January 30	do	18.80	3,622
February 1	do	18.85	3,649
February 4	do	18.90	3,812
February 6	do	18.90	3,736
February 9	do	18.75	3,484
February 11	do	18.70	3,342
February 13	do	18.75	3,540
February 16	do	18.75	3,490
February 18	do	18.95	3,753
February 20	do	19.05	3,794
February 22	do	19.20	4,162
February 25	do	19.35	4,229
February 27	do	19.25	4,247
March 1	do	19.45	4,446
March 3	do	19.50	4,627
March 5	do	19.55	4,725

Discharge measurements of Colorado River at Yuma, Ariz., in 1904—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 8	W. D. Smith	19.70	4,943
March 10	do	19.90	5,526
March 12	do	20.00	5,720
March 14	do	20.55	9,320
March 15	do	20.25	8,141
March 17	do	19.90	7,111
March 19	do	19.85	6,645
March 22	do	19.80	5,795
March 25	do	19.95	5,861
March 29	do	20.15	6,250
March 31	do	20.05	5,971
April 2	do	20.00	5,926
April 5	do	20.15	6,046
April 7	do	20.50	7,033
April 9	do	20.40	6,984
April 11	do	20.05	6,430
April 14	do	19.95	5,847
April 16	do	19.95	5,823
April 19	do	20.15	6,323
April 21	do	20.25	5,964
April 23	do	20.30	6,173
April 26	do	21.30	13,534
April 28	do	21.80	17,605
April 29	do	22.00	19,204
May 2	do	21.70	17,838
May 4	do	21.70	17,959
May 6	do	21.50	17,046
May 7	J. N. Johannsen	21.85	18,407
May 9	W. D. Smith	22.30	20,916
May 10	do	22.95	26,036
May 11	do	22.85	25,605
May 14	do	22.50	22,854
May 16	do	22.60	23,123
May 19	do	22.90	25,083
May 21	do	23.55	32,200
May 23	do	23.95	32,523
May 25	do	24.10	35,653
May 27	J. N. Johannsen	24.70	40,839
May 31	do	25.40	46,677
June 2	do	25.95	46,956

Discharge measurements of Colorado River at Yuma, Ariz., in 1904—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 5	W. D. Smith	26.25	49,485
June 7	do	26.00	51,170
June 9	do	25.90	49,183
June 11	do	25.50	45,820
June 13	N. J. Johannsen	24.90	42,295
June 15	W. D. Smith	24.70	34,256
June 17	do	24.80	38,192
June 20	do	25.00	38,981
June 22	do	25.40	43,202
June 24	do	25.70	45,435
June 27	do	25.65	43,706
June 29	do	25.55	44,909
July 2	J. N. Johannsen	25.15	35,701
July 5	do	24.25	32,421
July 7	W. D. Smith	24.00	32,186
July 9	S. M. Smith	23.80	27,608
July 11	do	23.40	23,675
July 13	do	23.00	22,761
July 15	do	23.05	22,269
July 18	do	22.85	21,050
July 21	do	22.55	18,681
July 22	do	22.50	18,178
July 25	do	22.20	15,269
July 28	do	22.25	16,044
July 30	do	21.90	13,939
August 1	do	22.20	16,193
August 4	do	22.25	15,973
August 6	do	21.85	15,427
August 8	do	22.15	16,357
August 12	W. D. Smith	21.95	17,686
August 16	do	21.95	16,660
August 18	do	21.65	14,636
August 20	do	21.50	14,199
August 23	do	21.30	12,957
August 24	do	23.00	23,652
August 26	do	22.25	18,740
August 30	S. M. Smith	22.80	23,185
September 1	do	22.10	18,358
September 5	do	22.00	18,060
September 7	do	22.40	18,351

Discharge measurements of Colorado River at Yuma, Ariz., in 1904—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 9	S. M. Smith	21.80	15,773
September 13	do	21.00	12,940
September 15	do	20.90	11,772
September 19	do	20.35	8,063
September 22	W. D. Smith	20.10	7,682
September 26	do	19.60	6,508
September 28	do	19.45	5,984
September 30	do	19.30	5,538
October 4	do	19.30	6,014
October 6	do	20.95	12,408
October 10	do	20.90	11,193
October 14	do	21.85	19,134
October 17	do	22.35	21,603
October 19	do	21.15	14,579
October 22	do	20.60	11,476
October 25	do	20.20	10,055
October 29	do	19.95	8,825
November 1	do	20.00	7,964
November 5	do	19.85	6,955
November 8	do	19.65	6,544
November 12	do	19.65	6,430
November 15	do	19.65	6,423
November 19	do	19.50	5,948
November 23	do	19.30	5,269
November 26	do	19.10	5,156
November 30	do	19.05	4,754
December 3	do	19.10	5,080
December 6	do	19.05	4,797
December 10	do	19.00	4,819
December 13	do	18.85	4,696
December 17	do	18.85	4,756
December 19	do	19.10	4,822
December 24	do	18.40	3,641
December 29	do	18.40	3,933

Mean daily gage height, in feet, of Colorado River at Yuma, Ariz., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	18.92	18.85	19.45	20.05	22.00	25.70	25.30	22.25	22.10	19.30	20.00	19.10
2	18.92	18.85	19.50	20.00	21.75	25.90	25.15	22.20	22.00	19.30	20.00	19.10
3	18.88	18.90	19.50	20.00	21.80	26.10	24.90	22.20	22.10	19.30	20.00	19.10
4	18.84	18.90	19.55	20.00	21.70	26.25	24.45	22.25	22.40	19.30	19.90	19.05
5	18.84	18.90	19.55	20.15	21.50	26.25	24.25	21.95	21.95	19.55	19.85	19.00
6	18.84	18.90	19.55	20.20	21.50	26.20	24.05	21.85	22.25	20.95	19.80	19.00
7	18.79	18.85	19.60	20.50	21.85	26.00	24.00	22.10	22.30	20.30	19.70	19.05
8	18.75	18.80	19.70	20.60	22.10	25.90	23.95	22.10	22.00	20.20	19.65	19.05
9	18.74	18.75	19.80	20.40	22.30	25.90	23.80	22.25	21.75	20.30	19.60	19.00
10	18.65	18.75	19.90	20.20	22.80	25.70	23.50	22.20	21.45	20.90	19.60	19.00
11	18.60	18.70	20.00	20.05	22.90	25.50	23.40	22.20	21.10	20.60	19.60	18.90
12	18.51	18.70	20.00	20.00	22.65	25.30	23.15	21.95	21.00	20.70	19.65	18.90
13	18.47	18.75	20.40	20.00	22.65	24.90	23.00	22.10	20.95	21.40	19.65	18.85
14	18.55	18.75	20.55	19.95	22.50	24.70	23.00	21.95	20.90	21.85	19.65	18.85
15	18.64	18.75	20.25	19.90	22.40	24.70	23.05	21.95	20.90	22.30	19.65	18.80
16	18.70	18.75	19.95	19.95	22.60	24.70	22.90	21.95	20.60	22.80	19.60	18.80
17	18.70	18.85	19.90	19.90	22.70	24.80	22.85	22.00	20.50	22.35	19.50	18.85
18	18.70	18.95	19.85	19.95	22.70	24.55	22.85	21.75	20.50	22.00	19.50	19.05
19	18.60	19.00	19.85	20.15	22.90	24.80	22.75	21.40	20.30	21.15	19.50	19.10
20	18.70	19.05	19.85	20.30	23.25	25.10	22.55	21.50	20.25	21.00	19.50	19.00
21	18.75	19.10	19.85	20.25	23.60	25.30	22.50	21.30	20.10	20.75	19.40	18.85
22	18.75	19.20	19.80	20.30	23.90	25.40	22.40	21.30	20.10	20.60	19.30	18.70
23	18.75	19.15	19.80	20.30	23.95	25.50	22.30	21.30	19.95	20.40	19.30	18.50
24	18.75	19.20	19.90	20.30	24.05	25.70	22.25	23.00	19.85	20.30	19.30	18.40
25	18.75	19.30	19.95	20.50	24.10	25.70	22.10	23.00	19.70	20.20	19.20	18.35
26	18.70	19.35	19.95	21.30	24.40	25.60	22.10	22.25	19.60	20.10	19.10	18.30
27	18.70	19.25	19.95	21.60	24.70	25.65	22.05	22.10	19.55	20.10	19.10	18.30
28	18.75	19.25	20.10	21.80	24.95	25.55	22.25	22.10	19.45	20.10	19.05	18.30
29	18.75	19.30	20.15	22.00	25.00	25.55	22.00	22.40	19.35	19.95	19.05	18.40
30	18.80	.....	20.15	22.00	25.05	25.50	22.00	22.90	19.30	19.95	19.05	18.60
31	18.80	.....	20.05	.....	25.30	.....	22.30	22.25	.....	19.95	.....	18.50

Estimated monthly discharge of Colorado River at Yuma, Ariz., for 1904.[a]

[Drainage area, 225,049 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	4,007	3,350	3,635	223,507	0.016	0.018
February	4,310	3,342	3,797	218,406	.017	.018
March	9,320	4,446	5,978	367,573	.027	.031
April	19,400	5,600	8,058	479,484	.036	.040
May	45,900	17,040	27,697	1,703,022	.123	.142
June	51,170	32,846	43,814	2,607,114	.195	.218
July	38,930	14,580	23,047	1,417,105	.102	.118
August	24,000	12,950	17,144	1,054,143	.076	.088
September	18,500	5,538	11,621	691,497	.052	.058
October	23,200	5,660	11,642	715,839	.052	.060
November	7,964	4,754	6,151	366,009	.027	.030
December	5,079	3,480	4,477	275,305	.020	.023
The year	51,170	3,342	13,922	10,119,004	.062	.844

[a] Computed by indirect method devised by W. B. Clapp. See article in Engineering News, April 21, 1904.

Summary of evaporation record at Yuma, Ariz., for 1904.

Month.	Evaporation.	Temperature.						Rain.	Net evaporation.
		Evaporation pan		Reservoir.		River.			
		7 a. m.	6 p. m.	7 a. m.	6 p. m.	7 a. m.	6 p. m.		
January	3.60	49.4	53.3	50.6	54.3	47.9	49.8	0.00	3.60
February	3.90	58.2	62.7	59.7	63.3	56.1	60.0	.00	3.90
March	6.47	63.8	68.8	65.9	69.8	61.8	62.3	.28	6.19
April	9.37	65.7	72.5	68.2	73.3	65.1	69.2	.00	9.37
May	10.01	72.2	77.7	74.1	78.0	70.0	73.8	.07	9.94
June	10.11	79.3	84.0	81.4	84.1	77.2	80.8	.00	10.11
July	10.24	83.6	83.1	85.6	89.4	81.8	82.7	.05	10.19
August	8.56	86.8	91.7	88.9	92.5	85.5	89.6	.69	7.87
September	6.62	80.6	86.5	81.4	86.3	80.2	83.4	.24	6.38
October	7.02	66.5	71.3	86.7	72.0	65.3	68.4	.00	7.02
November	4.41	56.4	60.7	59.2	62.1	54.8	57.7	.00	4.41
December	2.01	49.9	53.2	52.2	54.3	48.2	49.9	.10	1.91
Total	82.32	.....	.....	.....	.....	.....	.....	1.43	80.89
Mean	.....	67.7	72.5	69.7	73.3	66.2	69.0	.....	.....

IMPERIAL CANAL AT CALIFORNIA-MEXICO BOUNDARY LINE.

Imperial canal heads about 10 miles, by river, below Yuma, Ariz., on the California side. The station is located a half mile from the river and 600 feet below the wooden head-gates. It was established October 24, 1903, by W. D. Smith. The vertical gage is located just above the boundary line on the right bank. It is read twice each day by J. S. Carter, the storekeeper. Discharge measurements are made by means of a boat and cable. The initial point for soundings is a charred post at the southeast corner of the corral about 150 feet west of the right bank. The channel is straight for 600 feet above and 300 feet below the cable and has a width of 70 feet. The velocity is moderate. There is but one channel at all stages, but when the gage at Yuma reads about 26 feet the river overflows into the channel below the gaging section. The bed of the canal is composed of silt and sand, free from vegetation, and is very unstable. The right bank is low and is liable to overflow. The left bank has an elevation of 6 feet above high water. Bench mark No. 1 is a standard United States Geological Survey iron bench-mark post. It is located near monument 207 of the United States and Mexico boundary line, on a hill

about half a mile west of the gaging station. Its elevation is 52.41 feet above the zero of the gage and 155 feet above sea level. Bench mark No. 2 is a nail in a tree on the right bank. Its elevation is 15.20 feet above the zero of the gage. Bench mark No. 3 is a nail in a post near the ground on the right bank near the corral. Its elevation is 14.90 feet above the zero of the gage.

On October 6, 1904, a new heading was opened on Mexican territory 4 miles below the original station for the diversion of additional water from Colorado River. Measurements were made in the canal below this heading, in order to obtain the total diversion.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Imperial canal at California-Mexico boundary line, head of canal (old gaging station), in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 1	W. D. Smith	8.60	455
January 15	do	8.30	410
January 27	do	8.30	408
February 12	do	8.30	438
February 26	do	8.82	551
March 16	do	10.16	780
Do	do	10.14	751
April 6	do	9.80	704
April 20	do	10.00	725
May 8	do	12.75	1,377
May 24	do	12.20	1,331
June 4	do	10.80	1,011
June 10	do	14.10	2,097
June 16	do	13.95	1,776
August 3	do	13.40	1,646
August 9	S. M. Smith	13.60	1,626
August 17	W. D. Smith	13.35	1,752
August 27	do	13.30	1,679
September 3	S. M. Smith	13.30	1,691
September 10	do	12.50	1,642
September 17	do	12.00	1,271
September 24	W. D. Smith	11.10	868
October 1	do	10.90	762

Mean daily gage height, in feet, of Imperial canal at California-Mexico boundary line, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.60	8.50	8.90	9.60	12.85	11.05	14.70	13.60	13.30	10.90	.....	.....
2	8.60	8.50	9.00	9.60	12.70	11.00	14.70	13.50	13.20	10.90	.....	.....
3	8.55	8.50	9.00	9.60	12.70	11.00	14.65	13.40	13.20	10.85	.....	.....
4	8.50	8.50	9.05	9.60	12.60	10.95	14.60	13.35	13.55	10.85	.....	.....
5	8.55	8.50	9.10	9.60	12.30	10.80	14.55	13.10	13.10	12.70	.....	.....
6	8.50	8.45	9.05	9.75	12.25	11.30	(a)	13.00	13.45	12.10	.....	.....
7	8.50	8.40	9.05	9.95	12.60	11.80	.....	13.40	13.55	.....	.....	.....
8	8.50	8.35	9.10	10.15	12.85	13.10	.....	13.20	13.20	.....	.....	.....
9	8.45	8.30	9.20	10.00	13.00	13.80	.....	13.70	12.95	.....	.....	.....
10	8.40	8.20	9.30	10.00	13.35	14.00	.....	13.60	12.55	12.60	.....	.....
11	8.35	8.35	9.45	9.90	13.50	13.95	.....	13.65	12.10	.....	.....	.....
12	8.30	8.35	9.55	9.90	13.00	14.10	.....	13.45	12.05	.....	.....	.....
13	8.20	8.35	9.95	9.80	12.70	b14.20	.....	13.45	12.10	.....	.....	.....
14	b8.25	8.40	10.70	9.85	12.00	14.30	.....	13.40	12.05	.....	.....	.....
15	b8.25	8.40	10.50	9.90	11.90	14.10	.....	13.20	12.10	14.15	.....	.....
16	b8.25	8.40	10.20	9.90	12.15	14.00	.....	13.30	11.90	(c)	.....	.....
17	b8.25	8.50	10.05	9.95	12.30	14.05	.....	13.25	11.95	.....	.....	.....
18	8.30	8.60	9.95	9.80	12.45	14.10	.....	12.85	11.80	.....	.....	.....
19	8.30	8.60	9.85	9.85	12.70	14.25	.....	12.70	11.65	.....	.....	.....
20	8.30	8.60	9.80	10.00	12.70	14.45	.....	12.70	11.55	.....	.....	.....
21	8.40	8.60	9.60	10.10	12.55	14.60	.....	12.60	11.30	.....	.....	.....
22	8.40	8.70	9.60	10.10	12.25	14.60	.....	12.55	11.20	.....	.....	.....
23	8.40	8.70	9.50	10.15	12.20	14.60	.....	12.50	11.20	.....	.....	.....
24	8.45	8.70	9.50	10.10	12.20	14.60	.....	13.85	11.20	.....	.....	.....
25	8.35	8.70	9.60	10.20	12.15	14.60	.....	14.10	11.15	.....	.....	.....
26	8.35	8.80	9.60	11.85	11.80	14.70	.....	13.50	11.15	.....	.....	.....
27	8.30	8.80	9.65	12.50	11.00	14.75	13.10	13.20	11.20	.....	.....	.....
28	8.40	8.80	9.65	12.80	11.15	14.70	13.05	13.30	11.10	.....	.....	.....
29	8.40	8.80	9.65	12.80	11.15	14.70	13.00	13.55	11.05	.....	.....	.....
30	8.40	.....	9.70	12.80	11.00	14.70	13.40	14.10	10.90	.....	.....	.....
31	8.40	.....	9.80	.....	10.50	.....	13.55	13.50	.....	.....	.....	.....

a Gage destroyed. Replaced July 27. b Estimated. c Station discontinued.

Discharge measurements of Imperial canal at heading in Mexico, 4 miles below the International boundary line (new gaging station), in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
October 7	W. D. Smith	10.60	1,213
October 15	do	12.75	1,976
October 21	do	10.60	1,356
October 28	do	9.35	1,016
November 4	do	9.30	898
November 11	do	9.20	937
November 18	do	8.95	954
November 25	do	8.85	886
December 2	do	8.60	826
December 9	do	8.85	879
December 20	do	8.90	899
December 28	do	8.00	607

IMPERIAL VALLEY CANALS.

In July, 1904, stations were established on all canals entering the Imperial Valley as follows: Holt canal, Hemlock canal, Alamo channel, Alamitos canal, Main canal, and Boundary canal. These stations are located on United States territory and in each case near the California-Mexico boundary line. Discharge measurements are made from foot-bridges constructed at each station. The gages are vertical rods fastened to 4 by 4 inch timbers substantially imbedded in the ground. Automatic water-stage registers, from which the daily gage height record is compiled, were placed at the first five stations mentioned above. These canals enter the valley east of Calexico, Cal. In October a canal, known as Canal No. 6, was completed, which enters the valley west of Calexico, Cal. A station was constructed on this canal in November, and weekly discharge measurements are being made. A large quantity of waste water was discharging from the Imperial Valley, below all irrigated lands, into the Salton Basin. To determine this waste, discharge measurements were made on New River at Brawley, on Alamo channel at Rockwood, and on Canal No. 5 at Bernice.

The observations at these stations during 1904 have been made under the direction of W. B. Clapp, district hydrographer.

Discharge measurements of Holt canal near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 14	W. V. Hardy	2.02	62.0
July 23	do	1.79	53.6
July 26	do	1.75	48.4
July 29	do	1.72	44.0
August 2	do	1.70	43.0
August 5	do	1.70	41.8
August 10	do	1.88	50.0
August 17	do	2.03	59.0
August 23	do	1.96	56.0
August 26	do	1.97	56.0
September 3	W. V. Hardy and E. C. La Rue	2.03	60.0
September 10	do	2.14	61.0
September 18	do	1.63	37.0
September 24	S. M. Smith	1.60	36.0
September 27	do	1.55	33.0
October 1	do	1.90	49.0
October 5	do	1.73	41.0
October 8	do	2.03	56.0

Discharge measurements of Holt canal near Calexico, Cal., in 1904—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
October 15	S. M. Smith	1.97	48.0
October 22	do	1.98	47.0
October 29	do	1.61	30.0
November 4	do	1.62	36.3
November 11	W. V. Hardy and S. M. Smith	1.95	54.0
November 18	W. V. Hardy	1.92	50.0
November 25	do	1.72	40.0
December 2	do	1.52	32.0
December 8	do	1.65	37.0
December 15	do	1.46	27.0
December 22	do	1.58	32.0

Mean daily gage height, in feet, of Holt canal near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.85	2.00	1.90	1.60	1.60
2		1.70	2.10	1.80	1.55	1.55
3		1.70	2.00	1.80	1.55	1.50
4		1.70	2.00	1.80	1.60	1.55
5		1.70	2.00	1.75	1.70	1.60
6		1.65	1.90	1.70	1.80	1.75
7		1.60	1.90	1.80	1.65	1.65
8		1.80	2.10	2.00	2.15	1.65
9		1.85	2.10	2.00	2.15	1.60
10		1.90	2.15	1.85	2.05	1.60
11		1.90	2.15	1.80	2.00	1.65
12		1.90	2.10	1.85	1.90	1.65
13		1.95	1.90	1.90	1.90	1.65
14		1.95	1.70	1.85	1.90	1.60
15		2.00	1.65	1.80	1.85	1.50
16		2.00	1.60	1.90	1.85	1.50
17		2.05	1.55	1.90	1.90	1.45
18		2.05	1.60	1.95	1.90	1.50
19		2.05	1.60	1.95	1.90	1.50
20		(2.05)	1.60	1.95	1.90	1.45
21		(2.05)	1.65	2.00	1.85	1.55
22	1.80	(2.00)	1.55	1.95	1.85	1.55
23	1.80	1.95	1.55	1.85	1.80	1.45
24	1.75	(1.95)	1.55	1.75	1.75	1.25
25	1.70	(1.95)	1.55	1.60	1.75	1.20
26	1.75	1.95	1.50	1.65	1.75	1.05
27	1.80	2.00	1.55	1.70	1.75	1.10
28	1.75	2.05	1.50	1.65	1.70	1.05
29	1.70	2.00	1.50	1.60	1.70	(1.05)
30	1.35	1.90	1.70	1.60	1.65	(1.05)
31	1.90	2.00		1.60		(1.05)

NOTE.—Gage heights in parenthesis are estimated.

Discharge measurements of Hemlock canal near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 23	W. V. Hardy	0.95	4.4
July 26	do	1.15	6.4
July 29	do	1.14	6.0
August 2	do	.92	3.6
August 5	do	1.20	7.3
August 10	do	1.00	4.4
August 17	do	1.08	5.7
August 23	do	1.03	5.0
August 26	do	1.02	4.9
September 3	W. V. Hardy and E. C. La Rue	1.02	4.3
September 10	do	1.07	4.6
September 18	do	1.44	11.5
September 24	S. M. Smith	1.10	3.9
September 27	do	1.10	4.5
October 1	do	1.79	14.5
October 5	do	1.15	5.4
October 8	do	1.31	8.2
October 15	do	1.45	8.8
October 22	do	1.50	10.6
October 29	do	.98	3.1
November 4	do	1.13	6.4
November 11	W. V. Hardy and S. M. Smith	1.29	8.0
November 18	W. V. Hardy	1.31	8.2
November 25	do	1.28	8.0
December 2	do	1.39	9.5
December 8	do	1.13	6.3
December 15	do	1.04	3.3
December 22	do	.88	1.8

Mean daily gage height, in feet, of Hemlock canal near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.95	0.95	1.70	1.05	1.20
2	.....	.90	.95	1.50	1.10	1.40
3	.....	.95	1.00	1.40	1.15	1.40
4	.....	1.10	1.05	1.35	1.15	1.40
5	.....	1.20	1.05	1.15	1.20	1.30
6	.....	1.30	1.05	1.05	1.25	.95
7	.....	(a)	1.05	1.05	1.35	1.15
8	.....	(a)	1.05	1.15	1.40	1.15
9	.....	.90	1.05	.85	1.35	1.10
10	.....	1.00	1.10	.80	1.30	1.10
11	.....	1.00	1.10	.75	1.30	1.10
12	.....	.80	1.05	.65	1.30	1.10
13	.....	.90	1.05	.95	1.30	1.10
14	.....	1.05	1.00	1.30	1.30	1.10
15	.....	1.05	1.05	1.45	1.35	1.00
16	.....	1.05	1.10	1.45	1.45	1.00
17	.....	1.10	1.05	1.45	1.45	.95
18	.....	1.05	1.20	1.45	1.35	.95
19	.....	1.10	1.65	1.45	1.30	.90
20	.....	(1.05)	1.35	1.50	1.30	.90
21	.....	(1.05)	1.10	1.50	1.30	.90
22	1.00	(1.05)	1.00	1.50	1.30	.90
23	.95	1.05	1.00	1.45	1.30	.85
24	1.00	(1.05)	1.00	1.35	1.30	.80
25	1.05	(1.00)	1.05	1.25	1.30	.80
26	1.15	1.00	1.10	1.15	1.30	.65
27	1.15	(1.05)	1.25	1.05	1.30	.60
28	.75	(1.05)	1.45	1.00	1.30	.75
29	1.15	(1.20)	1.35	1.00	1.25	(.75)
30	1.15	(1.25)	1.35	1.05	1.20	(.75)
31	1.00	(1.05)	.....	1.05	.....	(.75)

a Dry.

NOTE.—Gage heights in parenthesis are estimated.

Discharge measurements of Alamo channel near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 14	W. V. Hardy	3.20	144
July 23	do	2.80	115
July 26	do	3.09	138
July 29	do	3.51	177
August 2	do	1.63	39
August 5	do	1.61	36.5
August 10	do	3.38	163
August 17	do	3.82	219
August 23	do	3.67	200
August 26	do	3.68	197
September 3	W. V. Hardy and E. C. La Rue	4.00	239
September 10	do	4.00	256
September 18	do	2.95	136
September 24	S. M. Smith	2.77	124
September 27	do	2.80	135
October 1	do	3.79	240
October 5	do	2.65	123
October 8	do	3.55	205
October 15	do	3.40	182
October 22	do	3.82	228
October 29	do	3.05	157
November 4	do	2.97	146
November 11	W. V. Hardy and S. M. Smith	3.04	152
November 18	W. V. Hardy	2.43	97
November 25	do	2.22	86
December 2	do	2.14	80
December 8	do	2.56	107
December 15	do	2.55	111
December 22	do	2.32	80

Mean daily gage height, in feet, of Alamo channel near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.80	(3.90)	3.75	2.95	2.10
2	.....	1.65	(3.90)	3.35	2.95	2.15
3	.....	1.65	4.00	3.00	2.95	2.15
4	.....	1.60	4.00	(2.70)	3.00	2.20
5	.....	1.60	4.00	2.65	2.70	2.30
6	.....	1.80	4.00	3.55	2.50	2.35
7	.....	2.50	4.00	2.75	2.50	2.55
8	.....	2.65	4.00	3.25	(3.00)	2.55
9	.....	2.85	4.00	3.50	(3.00)	2.55
10	.....	3.40	4.00	3.45	(3.00)	2.60
11	.....	3.60	4.00	3.40	3.00	2.60
12	.....	3.60	3.95	3.40	2.75	2.60
13	.....	3.50	3.65	3.40	2.50	2.60
14	.....	3.65	3.35	3.35	(2.40)	2.55
15	.....	3.65	(3.00)	3.40	(2.40)	2.55
16	.....	3.75	(2.90)	3.45	(2.40)	(2.55)
17	.....	3.80	(2.90)	3.40	(2.40)	(2.55)
18	.....	3.80	2.90	3.50	2.40	(2.50)
19	.....	3.80	2.90	3.75	2.40	(2.50)
20	.....	3.80	2.90	3.80	3.40	(2.40)
21	.....	3.80	2.80	3.85	2.35	(2.35)
22	3.25	3.80	2.70	3.80	2.30	2.30
23	2.80	3.65	2.75	3.70	2.25	2.15
24	2.90	3.65	2.75	3.25	2.25	2.00
25	2.95	3.70	2.80	3.20	2.20	(2.00)
26	3.10	3.70	2.75	3.25	2.25	(2.00)
27	3.30	3.80	2.80	3.15	2.25	(1.90)
28	3.40	3.80	2.75	3.05	2.20	(1.80)
29	3.50	3.80	2.95	3.00	2.15	1.75
30	3.60	3.80	3.40	3.00	2.10	(1.75)
31	3.80	3.80	.....	2.95	.....	(1.75)

NOTE.—Gage heights in parenthesis are estimated.

Discharge measurements of Alamitos canal near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 14	W. V. Hardy	1.40	26.6
July 23	do	1.48	24.3
July 26	do	1.30	18.4
July 29	do	1.50	26.3
August 2	do	1.08	8.2
August 5	do	1.04	13.3
August 10	do	.81	3.0
August 17	do	1.20	17.7
August 23	do	1.17	17.4
August 26	do	1.13	15.6
September 3	do	1.10	16.3
September 10	do	1.15	21.0
September 18	do	1.39	31.0
September 24	S. M. Smith	.87	8.3
September 27	do	1.02	13.7
October 1	do	1.10	8.4
October 5	do	1.19	18.7
October 8	do	1.54	36.0
October 15	do	1.50	35.0
October 22	do	1.30	26.0
October 29	do	1.24	25.0
November 4	do	1.21	23.0
November 11	S. M. Smith and W. V. Hardy	1.37	30.0
November 18	W. V. Hardy	1.48	35.0
November 25	do	1.48	26.0
December 2	do	1.34	22.0
December 8	do	1.41	25.0
December 15	do	1.43	26.0
December 22	do	1.46	29.0

Mean daily gage height, in feet, of Alamitos canal near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.00	(1.10)	1.10	1.25	1.35
2	.....	1.10	(1.10)	.65	1.25	1.35
3	.....	1.10	1.10	.90	1.25	1.35
4	.....	1.05	1.05	1.15	1.25	1.35
5	.....	1.05	1.10	1.25	1.30	1.35
6	.....	1.00	1.10	1.30	1.35	1.40
7	.....	1.00	(1.10)	1.40	1.25	1.40
8	.....	.90	1.15	1.45	1.20	1.40
9	.....	1.00	1.15	1.35	1.25	1.50
10	.....	.80	1.15	1.35	1.30	1.60
11	.....	.90	1.15	1.35	1.35	1.45
12	.....	.85	1.20	1.35	1.45	1.40
13	.....	.95	1.15	1.40	1.45	1.45
14	.....	1.00	1.15	1.45	1.45	1.45
15	.....	1.10	1.10	1.50	1.45	1.45
16	.....	1.15	1.15	1.55	1.45	1.45
17	.....	1.20	1.25	1.10	1.45	1.45
18	.....	1.20	1.40	.90	1.50	1.45
19	.....	1.20	1.30	.80	1.45	1.45
20	.....	(1.20)	1.25	1.15	(a)	1.50
21	.....	1.15	1.15	1.35	(a)	1.50
22	1.40	(1.10)	1.10	1.30	1.35	1.45
23	1.50	1.10	1.00	1.30	1.40	1.40
24	1.40	(1.05)	.95	1.25	1.40	1.35
25	1.35	(1.05)	1.10	1.25	1.40	1.25
26	1.30	1.05	1.05	1.25	1.40	1.20
27	1.35	1.05	1.05	1.25	1.40	1.30
28	1.40	(1.05)	1.10	1.25	1.40	1.40
29	1.50	(1.05)	1.15	1.25	1.40	(1.40)
30	1.50	(1.00)	1.00	1.25	1.40	(1.40)
31	1.65	(1.00)	.....	1.25	.....	(1.40)

a Dry.

NOTE.—Gage heights in parenthesis are estimated.

Discharge measurements of Imperial canal (main) near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 14	W. V. Hardy	4.60	615
July 21	do	4.60	642
July 23	do	4.53	625
July 26	do	4.32	598
July 29	do	4.03	519
August 2	do	4.73	652
August 5	do	4.83	677
August 10	do	4.16	556
August 17	do	4.72	644
August 23	do	4.74	669
August 26	do	4.76	696
September 3	do	4.93	717
September 10	do	4.91	682
September 18	do	4.62	662
September 24	do	4.27	573
September 27	S. M. Smith	4.10	560
October 1	do	3.11	249
October 5	do	3.97	474
October 8	do	4.13	548
October 15	do	4.59	642
October 22	do	4.70	639
October 29	do	4.63	656
November 4	S. M. Smith and W. V. Hardy	4.45	598
November 11	do	4.41	601
November 18	W. V. Hardy	4.62	620
November 25	do	4.54	602
December 2	do	4.48	586
December 8	do	4.45	573
December 15	do	4.42	561
December 22	do	4.40	563

Mean daily gage height, in feet, of Imperial canal (main) near Calexico, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.60	4.85	2.90	4.50	4.50
2	.....	4.75	4.90	3.50	4.50	4.45
3	.....	4.70	4.95	3.80	4.45	4.45
4	.....	4.85	4.90	4.05	4.45	4.45
5	.....	4.80	4.90	4.00	4.50	4.50
6	.....	4.80	4.90	3.95	4.55	4.50
7	.....	4.70	4.90	4.00	4.25	4.45
8	.....	4.55	4.90	4.15	4.25	4.45
9	.....	4.40	4.90	4.25	4.30	4.45
10	.....	4.15	4.90	4.40	4.35	4.40
11	.....	4.20	4.90	4.40	4.40	4.45
12	.....	4.30	4.85	4.40	4.50	4.45
13	.....	4.40	4.80	4.40	4.55	4.45
14	4.60	4.55	4.75	4.55	4.55	4.40
15	4.60	4.65	4.75	4.60	4.55	4.40
16	4.70	4.65	4.75	4.60	4.60	(4.40)
17	4.60	4.70	4.65	4.70	4.60	(4.40)
18	4.60	4.75	4.60	4.75	4.60	(4.40)
19	4.60	4.90	4.60	4.80	4.65	(4.40)
20	4.60	4.75	4.55	4.75	4.70	(4.40)
21	4.60	4.75	4.55	4.70	4.70	(4.40)
22	4.55	4.75	4.50	4.70	4.60	4.40
23	4.55	4.75	4.35	4.65	4.55	4.35
24	4.50	4.75	4.15	4.65	4.55	4.30
25	4.45	4.75	4.10	4.60	4.55	4.20
26	4.30	4.75	4.10	4.65	4.55	4.15
27	4.25	4.80	4.15	4.60	4.60	4.10
28	4.00	4.80	4.15	4.60	4.55	4.00
29	4.00	4.85	4.10	4.65	4.55	(4.00)
30	4.00	4.85	3.30	4.60	4.50	(4.00)
31	4.10	4.85	.....	4.55	.....	(4.00)

NOTE.—Gage heights in parenthesis are estimated.

Discharge measurements of Boundary canal near Calexico, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 23	W. V. Hardy	1.20	10.0
July 26	do	1.20	10.0
July 29	do	1.15	9.1
August 2	do	1.65	12.7
August 5	do	1.10	13.0
August 10	do	1.06	10.5
August 17	do	.91	8.3
August 23	do	.85	11.9
August 26	do	1.10	15.6
September 3	W. V. Hardy and E. C. LaRue	1.07	13.2
September 10	do	1.08	12.9
September 18	do	.85	7.5
September 24	S. M. Smith	.99	11.0
September 27	do	.90	9.9
October 1	do	1.00	10.8
October 5	do	1.00	10.0
October 8	do	1.00	9.4
October 15	do	.90	5.9
October 22	do	.10	7.0
October 29	do	.10	7.0
November 4	W. V. Hardy	.78	6.2
November 11	S. M. Smith and W. V. Hardy	.85	6.6
November 18	W. V. Hardy	.82	6.3
November 25	do	.82	6.2
December 2	do	.84	7.0
December 8	do	.65	4.8
December 15	do	.74	5.5
December 22	do	.46	4.0

Waste measurements in Imperial Valley in 1904.

Date.	Hydrographer.	Stream.	Location.	Discharge.
October 10	W. V. Hardy and S. M. Smith.	New River	Brawley, Cal	208
October 11	do	Alamo channel	Rockwood, Cal.	43
		Canal No. 5	Bernice, Cal	([a])
October 18	S. M. Smith	New River	Brawley, Cal	380
October 18	do	Alamo channel	Rockwood, Cal.	45
October 19	do	Canal No. 5	Bernice, Cal	77
		Total waste		502
October 31	W. V. Hardy and S. M. Smith.	New River	Brawley, Cal	381
November 1	do	Alamo channel	Rockwood, Cal.	59
November 1	do	Canal No. 5	Bernice, Cal	58
		Total waste		498
November 9	W. V. Hardy	New River	Brawley, Cal	318
November 9	do	Alamo channel	Rockwood, Cal.	49
November 9	do	Canal No. 5	Bernice, Cal	0
		Total waste		367
November 16	do	New River	Brawley, Cal	270
November 15	do	Alamo channel	Rockwood, Cal.	117
November 15	do	Canal No. 5	Bernice, Cal.	1
		Total waste		388
November 24	do	New River	Brawley, Cal	311
November 22	do	Alamo channel	Rockwood, Cal.	81
November 22	do	Canal No. 5	Bernice, Cal	3
		Total waste		395
November 30	do	New River	Brawley, Cal	231
November 30	do	Alamo channel	Rockwood, Cal.	73
November 30	do	Canal No. 5	Bernice, Cal	0
		Total waste		304
December 6	do	New River	Brawley, Cal	257
December 6	do	Alamo channel	Rockwood, Cal.	46
December 6	do	Canal No. 5	Bernice, Cal	0
		Total waste		303
December 13	do	New River	Brawley, Cal	301
December 13	do	Alamo channel	Rockwood, Cal.	52
December 13	do	Canal No. 5	Bernice, Cal	0
		Total waste		353
December 24	W. V. Hardy	New River	Brawley, Cal	254
December 24	do	Alamo channel	Rockwood, Cal.	39
December 24	do	Canal No. 5	Bernice, Cal	0
		Total waste		293

[a] No measurement made.

Miscellaneous measurements in Colorado River drainage basin in 1904.

Date.	Hydrographer.	Stream.	Location.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
February 22	W. D. Smith and S. M. Woodward.	Colorado Valley Pumping and Irrigation Company canal.	At heading.	1.11	19.8
February 22	do	do	do		9.9
February 23	do	do	do	.89	11.5
February 23	do	do	do		11.8
February 23	do	do	do		11.8
February 23	do	do	do		11.2
May 8	W. D. Smith	Ludy canal	do		50
May 24	do	do	do		59
June 4	do	do	do		158
June 16	do	do	do		92
July 27	do	do	do		185
May 8	do	Farmers canal	do		63
May 24	do	do	do		97
June 4	do	do	do		56
June 16	do	do	do		35
July 27	do	do	do		47
August 9	S. M. Smith	do	do		70
August 4	W. D. Smith	Imperial canal	Junction with Carter River, Mexico.		309
August 3	do	Main channel Imperial canal.	Below Best's Camp, Mexico.		525
August 3	do	Padrone River diversion (waste from Imperial canal.)	Best's Camp, Mexico.		609
October 12	S. M. Smith	New River	Calexico, Cal.		154
November 2	W. V. Hardy and S. M. Smith.	do	do		52
November 10	S. M. Smith	do	do		28
November 17	W. V. Hardy	do	do		24
November 23	do	do	do		20
December 1	do	do	do		18.6
December 7	do	do	do		16.7
December 14	do	do	do		22
December 21	do	do	do		10.2

DUTY OF WATER AND SEEPAGE INVESTIGATIONS NEAR YUMA, ARIZ.

[By W. D. Smith.]

The following is a statement of the investigations made on the duty of water for mixed crops under the right and left branches of the Colorado Valley Pumping and Irrigation Company canal, the duty of water for alfalfa on the Laselle and Rose ranches, and the seepage loss in the left branch of the Colorado Valley Pumping and Irrigation Company canal (commonly known as the Ives ditch). All of these lands lie in the upper part of the Yuma Valley, within 6 miles of Yuma, where the pumping plant is located. The results are representative of the Yuma project as a whole, with the exception of the seepage loss, which is believed to be somewhat high.

The climatic conditions have been normal. At the end of the year the zanjero, Mr. S. P. Huss, was asked if he thought the amount of water used was more or less than usual, and he said, "Probably a little less, for the following reasons: Colorado River during the months of August, September, and October has carried an abnormal amount of fine light mud, due to the heavy discharge of Gila River and other Arizona streams. This was carried through the canals to the lands irrigated and prevented the water from soaking in readily. In the same way seepage in the ditches was reduced." Mr. Huss states that he observed a marked difference in the amount of time it required to irrigate the same acreage with a given head of water, and that this was not entirely offset by more frequent irrigations. The alfalfa crop appears to have been slightly reduced from this cause. The water costs the irrigators $1 or more per acre-foot and is, therefore, not wasted, but the scattering location of the farms and the slow velocity of water in the canals and laterals increases the amount lost by seepage. The areas were obtained from the best available sources. The Laselle and Rose ranches were surveyed by the writer.

Four measuring flumes were used, on which nilometer records were kept. Weir measurements would have been unsatisfactory on account of the large amount of sediment carried in the water. The rating of these flumes was constantly changing by the steady filling of the canals with silt. This necessitated frequent ratings, or single-meter measurements, and at the end of the year, or just before the cleaning of the canal of silt, tables were constructed for periods of from two weeks to two or three months, according to conditions.

Another serious difficulty was the light grade of the canals and the fact that they were discharging nearly their full capacity. This made it almost impossible to locate the flumes where the rating would not be affected by check gates in the canal. In the case of flumes Nos. 2 and 4 this might have been overcome by locating them above the company's weirs, but the advantages would have been offset by the

fact that here the canals are more often cleaned of silt. The flumes were rated with the check gates removed and with them in place, designated as "rating *a*" and "rating *b*," respectively. This would not have been a complete success without the hearty cooperation of Mr. S. P. Huss, the zanjero, in operating the check gates and keeping a record of the same when requested; also the cooperation of Messrs. J. M. Boxley and John Lamar, managers of the Laselle and Rose ranches, respectively.

By the kindness of the engineer, Mr. H. Alexander, another check was obtained on the "*a*" and "*b*" ratings and on the clock records as a whole. Mr. Alexander kept an accurate record for the whole year of the number of hours the pump was in operation each day and the number of irrigating heads pumped. An irrigating head is about 12 second-feet.

Flume No. 4 is the property of the agricultural experiment station at Tucson, Ariz. The nilometer on this flume is of French make. The other three were manufactured by Julian P. Friez, of Baltimore, Md. The French machine gave much better results than the latter. In carrying out this work no impossible degree of accuracy has been attempted, but no pains have been spared to make the results absolutely reliable and reasonably accurate.

Monthly duty of water of right branch of Colorado Valley Pumping and Irrigation Company canal at Yuma, Ariz.

Month.	Acre-feet.	
	Total.	Per acre.
January	356.0	0.20
February	517.9	.29
March	1,188.5	.66
April	966.2	.54
May	966.3	.54
June	1,284.6	.71
July	1,033.1	.57
August	576.9	.32
September	794.0	.44
October	748.4	.41
November	0.0	.00
December	316.0	.18
Total	8,747.8	4.86

NOTE.—The above includes seepage losses. Crops, mixed. Net area, 1,800 acres.

Monthly duty of water of left branch of Colorado Valley Pumping and Irrigation Company canal at Yuma, Ariz.

Month.	Acre-feet.	
	Total.	Per acre.
January	100.7	0.22
February	105.5	.23
March	174.5	.39
April	249.6	.55
May	243.8	.54
June	398.0	.88
July	330.8	.73
August	245.8	.55
September	204.0	.45
October	223.9	.50
November	0.0	.00
December	51.5	.11
Total	2,328.1	5.15

NOTE.—The above includes seepage losses. Crops, mixed. Net area, 450 acres.

Monthly duty of water at Laselle ranch, Yuma, Ariz.

Month.	Acre-feet.	
	Total.	Per acre alfalfa.
January	76.0	0.58
February	48.5	.37
March	64.3	.49
April	66.9	.51
May	109.1	.83
June	53.3	.40
July	140.7	1.07
August	65.3	.49
September	80.9	.61
October	74.9	.57
November	0.0	.00
December	0.0	.00
Total	779.9	5.92

NOTE.—Acreage, net: Alfalfa, 128 acres; wheat, 17 acres; total, 145 acres; which is equivalent to 132 acres of alfalfa.

REMARKS.—The measuring flume is 1,100 feet above the first lateral, so that the loss by seepage after passing the flume and before reaching the ranch is probably about 1 per cent. The soil is very sandy. Most of the alfalfa was cut, but a part was used as pasture. Plenty of water was used, but apparently none was wasted.

Monthly duty of water at Rose ranch, Yuma, Ariz.

Month.	Acre-feet.	
	Total.	Per acre.
January	0.0	0.00
February	0.0	.00
March	13.8	.72
April	15.2	.79
May	10.0	.52
June	14.9	.77
July	12.3	.64
August	8.0	.42
September	8.2	.43
October	13.8	.72
November	0.0	.00
December	2.2	.11
Total	98.4	5.12

NOTE.—Acreage, net: Alfalfa, 19.26 acres.

REMARKS.—7.19 acres of above was wheat and young alfalfa so irrigated as to make total equivalent to 17.7 acres of old alfalfa. These measurements were made at the ranch and do not include loss by seepage.

Monthly duty of water of Colorado Valley Pumping and Irrigation Company canal at Yuma, Ariz.

	Acre-feet.		
	Total.	Per acre gross area.	Per acre net area.
January	456.7	0.07	0.20
February	623.4	.10	.28
March	1,363.0	.21	.60
April	1,215.0	.19	.54
May	1,210.1	.19	.54
June	1,682.6	.26	.75
July	1,363.9	.21	.60
August	822.7	.13	.37
September	998.0	.15	.44
October	972.2	.15	.43
November	0.0	.00	.00
December	367.5	.06	.16
Total	11,075.9	1.72	4.91

NOTE.—The above includes loss by seepage.

REMARKS.—Mixed crops: Alfalfa, 1,365 acres; grain, 475 acres; corn and sorghum, 245 acres; miscellaneous, 165 acres. Total net area, 2,250 acres; total gross area, 6,500 acres. Number of irrigators, 75.

Cost of pumping, Colorado Valley Pumping and Irrigation Company canal, at Yuma, Ariz.

Irrigation No.	Month.	Hours pumping.	Acre-feet pumped.	Average lift.	Expense.	Cost per acre-foot.	Cost per foot of raising 1 acre-foot.
1	January	156	457	11.5	$240	$0.53	$0.046
2	February	342	1,173	10.8	564	.48	.044
3	March	230	816	10.5	411	.50	.048
4	April	380	1,216	10.1	607	.50	.050
5	May	183	582	8.7	312	.54	.062
6	May	213	628	7.5	310	.50	.067
7	June	200	623	5.1	271	.43	.084
8	June	220	685	6.4	311	.45	.070
9	June	240	718	6.3	330	.46	.073
10	July	220	706	8.3	362	.51	.061
11	August	300	644	8.9	345	.54	.061
12	August	200	439	8.9	260	.59	.066
13	September	180	480	8.9	340	.71	.080
14	September	175	572	10.7	354	.62	.058
15	October	200	574	9.7	310	.54	.056
16	October	200	456	10.1	302	.66	.065
17	December	180	368	11.4	315	.86	.075
	Total	3,819	11,079	9.05	5,944	.54	.060

NOTE.—The engineer's salary is $100 per month, and this increased the cost per acre-foot in the months when little water was pumped.

Monthly expense.

Month.	Labor.	Wood.	Oil.	Miscellaneous.	Total.
January	$88	$126	$0	$17	$231
February	132	4	170	27	333
March	174	91	320	45	630
April	180	88	312	26	606
May	172	91	305	32	600
June	188	130	340	32	690
July	190	140	328	36	694
August	174	10	352	30	566
September	158	63	280	35	536
October	172	80	288	51	591
November	100	0	0	9	109
December	134	70	80	74	358
Total	1,862	893	2,775	414	5,944

Seepage loss of Ives ditch (Left Branch Colorado Valley Pumping and Irrigation Company canal) at Yuma, Ariz.

[Distance, 4.26 miles.]

	Per cent.
March 21	10
April 18	17
May 9	14
May 23	18
July 2	19
July 17, a. m	16
July 17, p. m	18
Mean	16

REMARKS.—This is the loss between flumes No. 2 and No. 3. The water travels this distance in four and one-half hours. In each case the register records show a constant head, and meter gagings were made in flume No. 3 (the lower one). In addition to this, meter gagings were made in flume No. 2 on May 9, May 23, and July 17, a. m. For the remaining determinations the discharge at flume No. 2 was taken from the rating tables. In each case search was made along the ditch for leaks, and there was a very small loss from this source, which was estimated to be about 2 per cent, making the actual loss by seepage about 14 per cent. The ditch has not been cleaned for several years and is heavily silted, but it passes through a sandy part of the valley.

SOUTHERN CALIFORNIA DRAINAGE.

Under the head of southern California drainage have been included data concerning the streams of that part of the State south of San Joaquin basin. There are thus included the Mohave, which flows from the mountains north of San Bernardino into the Mohave Desert, a portion of the great Interior Basin, as well as those flowing toward the south or southwest, whose waters, in times of flood at least, reach the Pacific Ocean.

Arroyo Seco rises on the eastern slope of the Santa Lucia Mountains and flows east and empties into Salinas River at Soledad, Cal.

Santa Maria River drains the northern and western slopes of the San Rafael Mountains and enters the Pacific Ocean at Guadalupe about 25 miles below San Luis Obispo. Its principal tributary is Sisquoc River which joins the Santa Maria about 12 miles above the town of Santa Maria. No water is diverted from either of these streams for irrigation.

Santa Ynez River drains the northern slope of the Santa Ynez and the southern slope of the San Rafael Mountains, and enters the Pacific Ocean below Lompoc, Cal., about 75 miles above Santa Barbara. The principal tributary of Santa Ynez River is Mono Creek, which rises on the southern slope of the San Rafael Mountains. There are several good reservoir and dam sites on these streams.

Malibu Creek rises in the Santa Monica Mountains and enters the Pacific Ocean about 15 miles above the town of Santa Monica. Truimfo

Creek is the principal tributary of Malibu Creek. Several storage reservoir and dam sites exist on these streams.

The drainage basin of San Gabriel River lies on the southern slope of the Sierra Madre, being included in Los Angeles County, Cal. The various tributaries join the river before it enters its lowest canyon, whence it appears finally on the plain in the vicinity of Azusa. The seepage waters of this valley appear lower down in the river and finally enter the Pacific Ocean not far from the mouth of Los Angeles River. All of the surplus waters of this stream are now used for irrigation purposes, and it is only an occasional flood that passes the gaging station.

Santa Ana River has its source on the southern slope of the San Bernardino Mountains and flows southerly, appearing from its canyon 4 miles north of Redlands. Its waters are completely used in San Bernardino Valley. At the lower part of the valley the water appears again in the vicinity of Rincon, where the river passes through a comparatively narrow gorge; thence the general direction of the stream is southwesterly, emptying into the Pacific Ocean.

The headwaters of Mohave River have their source on the northern slopes of the San Bernardino Mountains. The river flows north, finally disappearing in the sands of the Mohave Desert.

San Luis Rey River rises on the western slope of the Coast Range and enters the Pacific Ocean at the town of Oceanside, San Diego County, Cal. The water is diverted at several points along this stream for irrigation.

The following pages give the results of data collected in southern California drainage during 1904:

ARROYO SECO NEAR SOLEDAD, CAL.

A gaging station was established by W. W. Cockins, jr., in December, 1900, at Foster's ranch, near Piney post-office, Cal. The high water of January, 1901, enlarged an old channel, and the gaging station was removed to Pettitt's ranch, 4 miles below. The purpose of establishing these gaging stations was to get the maximum flood discharge and the amount of water available for storage. The total area of the basin drained above Pettitt's ranch is 215 square miles. The observer is Mrs. Charles Pettitt.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Arroyo Seco near Soledad, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 22	F. R. S. Buttemer	5.52	24
February 5	F. W. Huber	6.08	150
February 13	W. B. Newhall	6.65	372
March 11	do	6.85	470
March 16	do	6.08	184
March 20	do	7.02	600
March 23	do	8.40	1,514
March 23	do	7.80	1,117
May 12	F. W. Huber	5.85	103
July 29	O. W. Peterson	5.20	1.1

Mean daily gage height, in feet, of Arroyo Seco near Soledad, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.45	5.50	6.10	6.60	6.10	5.60	5.35	5.15	4.55	5.40	5.50	5.50
2	5.50	5.50	6.00	6.50	6.00	5.60	5.35	5.20	4.50	5.40	5.50	5.45
3	5.50	5.50	5.90	6.35	5.95	5.60	5.35	5.15	4.50	5.35	5.50	5.45
4	5.50	5.45	5.90	6.30	5.90	5.60	5.35	5.15	4.40	5.35	5.50	5.45
5	5.50	6.10	5.85	6.20	5.90	5.60	5.35	5.20	4.35	5.35	5.50	5.45
6	5.50	5.80	5.80	6.15	5.85	5.55	5.30	5.20	4.30	5.35	5.50	5.45
7	5.50	5.75	5.75	6.10	5.85	5.55	5.30	5.15	4.30	5.40	5.45	5.45
8	5.50	5.70	5.70	6.10	5.80	5.50	5.30	5.15	4.25	5.40	5.45	5.45
9	5.50	5.70	5.70	6.00	5.80	5.50	5.30	5.10	4.15	6.10	5.45	5.45
10	5.50	5.70	8.15	6.00	5.80	5.50	5.30	5.10	4.10	6.20	5.45	5.50
11	5.50	5.70	7.00	6.00	5.80	5.50	5.30	5.10	4.00	7.00	5.45	5.45
12	5.45	6.90	6.55	5.90	5.80	5.50	5.30	5.10	4.00	6.10	5.45	5.45
13	5.45	6.60	6.30	5.90	5.75	5.45	5.30	5.10	4.00	5.85	5.45	5.45
14	5.45	6.00	6.20	5.90	5.70	5.45	5.30	5.05	3.95	5.75	5.40	5.45
15	5.45	5.90	6.20	5.90	5.70	5.45	5.30	5.05	3.95	5.70	5.50	5.45
16	5.45	8.40	6.10	5.85	5.70	5.45	5.30	5.05	3.90	5.65	5.55	5.45
17	5.45	6.45	6.15	5.80	5.70	5.45	5.30	5.05	3.85	5.60	5.50	5.45
18	5.50	6.10	6.85	8.00	5.70	5.45	5.30	5.00	3.80	5.60	5.50	5.45
19	5.60	5.90	6.50	6.80	5.70	5.45	5.30	5.00	3.75	5.55	5.50	5.45
20	5.60	6.00	7.00	6.45	5.70	5.40	5.30	5.00	3.70	5.55	5.50	5.45
21	5.55	5.80	6.70	6.30	5.70	5.40	5.25	5.00	3.70	5.55	5.50	5.45
22	5.55	5.75	6.50	6.20	5.70	5.40	5.25	5.00	3.70	5.50	5.50	5.45
23	5.50	5.70	8.50	6.10	5.70	5.40	5.25	4.95	4.05	5.50	5.50	5.45
24	5.50	5.70	7.75	6.10	5.65	5.40	5.25	4.90	5.80	5.50	5.45	5.45
25	5.50	5.75	7.10	6.10	5.65	5.40	5.20	4.90	5.60	5.50	5.45	5.75
26	5.50	5.80	6.80	6.10	5.60	5.40	5.20	4.85	5.80	5.50	5.50	5.55
27	5.50	6.80	6.55	6.10	5.60	5.40	5.20	4.80	5.60	5.50	5.50	5.50
28	5.50	6.60	6.50	6.10	5.60	5.35	5.20	4.80	5.50	5.50	5.50	5.50
29	5.50	6.25	7.35	6.05	5.60	5.35	5.20	4.70	5.50	5.50	5.50	5.50
30	5.50	.....	7.00	6.00	5.60	5.35	5.20	4.65	5.40	5.50	5.50	5.50
31	5.50	.....	6.80	.....	5.60	.....	5.20	4.60	.....	5.50	.....	7.40

Rating table for Arroyo Seco River near Soledad, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.00	0	6.30	230	7.60	930	8.90	1,960
5.10	0.5	6.40	270	7.70	1,000	9.00	2,050
5.20	1	6.50	310	7.80	1,070	9.20	2,250
5.30	3	6.60	360	7.90	1,140	9.40	2,460
5.40	9	6.70	410	8.00	1,210	9.60	2,680
5.50	18	6.80	460	8.10	1,290	9.80	2,900
5.60	30	6.90	510	8.20	1,370	10.00	3,140
5.70	48	7.00	560	8.30	1,450	10.20	3,380
5.80	71	7.10	620	8.40	1,530	10.40	3,620
5.90	100	7.20	680	8.50	1,610	10.60	3,880
6.00	130	7.30	740	8.60	1,690	10.80	4,140
6.10	160	7.40	800	8.70	1,780	11.00	4,410
6.20	195	7.50	860	8.80	1,870	11.50	5,150

Estimated monthly discharge of Arroya Seco near Soledad, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	30	14	18	1,107	0.08	0.09
February	510	14	181	10,411	.83	.90
March	1,610	48	394	24,226	1.82	2.10
April	1,210	71	214	12,734	.99	1.10
May	160	30	62	3,812	.29	.33
June	30	6	16	952	.07	.08
July	6	1	3	184	.01	.01
August	1	0	0	0	.00	.00
September	71	0	8	476	.04	.04
October	560	6	54	3,320	.25	.29
November	24	9	17	1,012	.08	.09
December	800	14	42	2,582	.19	.22
The year	1,610	0	84	60,816	.39	5.25

SANTA YNEZ RIVER NEAR SANTA BARBARA, CAL.

The original station at which measurements were made during the greater part of 1903 is located about 1 mile above the mouth of Mono Creek. It was established November 21, 1902, by W. B. Clapp, assisted by Howard Rankin. The gage is an inclined rod on the right bank. From January 25 to June 20, 1903, daily discharge measurements were made by means of a cable and car. The channel is straight for 400 feet above and for 600 feet below the cable. The current is sluggish at low stages. The right bank is low, but will overflow for only a short distance. There is an overflow channel on the left bank. The bed of the stream is composed of gravel and is permanent. The bench mark is a nail in the root of the poplar tree on the left bank to which the cable is attached. Its elevation is 7.18 feet above the zero of the gage. On November 1, 1903, a new station was established at the Gibraltar dam site by L. M. Hyde, assisted by H. W. Muzzall. It is located 5 miles below the original station and is below the mouth of Mono Creek. It is 9 miles above the San Marcus ranch and halfway between the old quicksilver mines. The gage is a 4 by 4 inch inclined timber, spiked to a cottonwood tree on the right bank. The tree is blazed above the gage rod for recording stages above the gage. Discharge measurements are made at high water by means of a cable 20 feet above the gage. Measurements can usually be made by wading. Weir measurements of the discharge were made daily from December 20 to 31, 1903. At the cable the initial point for soundings is a blaze at the base of the cottonwood tree on the right bank, to which the cable is attached. The channel is straight for 700 feet above and for 600 feet below the station. The right bank is low, but is not liable to overflow. The left bank rises abruptly about 20 feet beyond the alder tree to which the cable is attached. It is not liable to overflow. The bed of the stream is composed of sandy gravel, free from vegetation and bowlders. The cross section is regular, and is permanent. The current is swift. The bench mark is a cross on a bench of a ledge on the left bank, about 100 feet below the cable. Its elevation is 13.54 feet above the zero of the gage. The approximate elevation above sea level, as estimated from topographic maps, is 1,200 feet.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Santa Ynez River near Santa Barbara, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 18	R. L. North	2.20	4.32
January 19	do	2.07	1.77
February 5	do	2.28	3.44
February 6	do		3.27
February 7	do	2.15	2.35
February 8	do	2.15	2.27
February 9	do	2.10	2.17
February 10	do	2.08	1.74
February 16	do		6.89
February 17	do		4.49
February 18	do		2.74
February 19	do		2.53
February 20	do		2.11
February 27	do		45.00
February 28	do	3.00	96.00
February 29	do	2.32	16.20
March 1	do		7.00
March 2	do		5.28
March 3	do		4.33
March 4	do		2.70
March 5	do		2.95
March 6	do		2.88
March 7	do		2.43
March 8	do		2.33
March 9	do		2.60
March 10	do		2.35
March 11	do	3.08	135.00
March 12	do	2.44	27.00
March 13	do	2.36	16.40
March 14	do	2.32	11.90
March 15	do	2.28	10.20
March 19	do	2.20	7.24
March 20	do	2.20	6.96
March 21	do	2.18	6.41
March 23	do	3.88	442.00
March 24	do	2.82	70.00
March 25	do	2.68	49.00
March 26	do	2.52	30.00
March 27	do	2.46	26.00
March 28	do	2.43	24.00
March 29	do	2.47	26.00
March 30	do	2.45	25.00

Discharge measurements of Santa Ynez River near Santa Barbara, Cal., in 1904—Contd.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 31	R. L. North	2.42	23.00
April 1	do	2.37	16.30
April 2	do	2.35	14.50
April 3	do	2.33	14.20
April 4	do	2.31	11.20
April 5	do	2.32	12.40
April 6	do	2.27	10.10
April 7	do	2.26	9.64
April 8	do	2.25	8.87
April 12	do	2.20	6.80
April 13	do	2.20	6.87
April 14	do	2.19	5.32
April 15	do	2.19	5.24
April 16	do	2.21	5.93
April 17	do	2.20	5.61
April 18	do	2.20	5.64
April 19	do	3.03	101.00
April 20	do	2.83	74.00
April 21	do	2.52	30.00
April 22	do	2.47	25.00
April 24	do	2.39	17.10
April 25	do	2.37	16.60
April 27	do	2.47	24.00
April 28	do	2.46	23.00
April 29	do	2.43	21.00
April 30	do	2.43	20.00
May 2	do	2.38	17.20
May 5	do	2.32	11.40
May 6	do	2.29	10.50
May 7	do	2.28	10.20
May 8	do	2.23	7.90
May 9	do	2.23	8.05
May 10	do	2.22	7.69
May 14	do	2.19	5.89
May 15	do	2.19	6.40
May 16	do	2.15	4.28
May 17	do	2.13	4.05
May 18	do	2.16	4.43
May 19	do	2.12	3.60
May 21	do	2.12	3.29
May 22	do	2.12	3.34

Discharge measurements of Santa Ynez River near Santa Barbara, Cal., in 1904—Cont'd.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 23	R. L. North	2.11	3.13
May 24	do	2.11	3.19
May 25	do	2.16	4.43
May 26	do	2.14	4.41
May 27	do	2.12	3.32
May 30	do	2.09	2.99
May 31	do	2.09	3.12
June 1	do	2.09	2.94
June 2	do	2.07	2.60
June 3	do	2.06	2.50
June 4	do	2.05	2.28
June 5	do	2.05	2.28
June 6	do	2.03	2.06
June 10	do	2.01	.94

Mean daily gage height, in feet, of Santa Ynez River near Santa Barbara, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)		2.21	2.36	2.40	2.09				2.37	2.18	2.20
2			2.13	2.34	2.38	2.08				2.32	2.19	2.20
3			2.12	2.32	2.33	2.06				2.30	2.19	2.21
4			2.09	2.31	2.34	2.05				2.27	2.19	2.21
5		2.28	2.09	2.31	2.32	2.05				2.26	2.19	2.21
6		2.27	2.09	2.27	2.30	2.03				2.27	2.19	2.20
7		2.15	2.08	2.26	2.27	2.02				2.36	2.19	2.21
8		2.15	2.08	2.25	2.24	2.02				2.38	2.19	2.20
9		2.10	2.09	2.25	2.23	2.02				2.34	2.19	2.21
10		2.08	2.70	b2.23	2.22	2.01				2.32	2.19	2.21
11			2.70	2.21	2.21	2.00				2.29	2.19	2.21
12			2.44	2.20	2.20	2.00				2.26	2.19	2.21
13			2.36	2.20	2.20					2.26	2.19	2.21
14			2.30	2.20	2.19					2.24	2.20	2.20
15			2.28	2.19	2.20		(c)			2.22	2.20	2.20
16			2.40	2.26	2.20	2.16				2.21	2.20	2.20
17		2.32	2.23	2.20	2.13					2.20	2.20	2.21
18	2.20	2.24	2.21	2.20	2.15					2.20	2.20	2.21
19	2.07	2.22	2.20	3.08	2.12					2.20	2.20	2.21
20		2.21	2.20	2.78	2.13					2.20	2.22	2.21
21		2.05	2.18	2.56	2.12					2.19	2.22	2.21
22			2.18	2.47	2.12					2.19	2.21	2.21
23			3.89	2.44	2.12					2.18	2.21	2.21
24			2.83	2.39	2.11				3.00	2.18	2.21	2.21
25			2.66	2.37	2.15				8.20	2.18	2.21	2.21
26			2.52	2.40	2.14				3.00	2.18	2.21	2.21
27		3.12	2.45	2.47	2.12				2.60	2.18	2.21	2.21
28		3.00	2.44	2.42	2.10				2.50	2.18	2.21	2.21
29		2.30	2.47	2.46	b2.10				2.45	2.18	2.20	2.21
30			2.44	2.43	2.09				2.40	2.18	2.20	2.21
31			2.40		2.09					2.18		2.32

a Measured over weir: January 1–17, 20–31; February 1–4, 11–15, 22–26; June 13–30; July 1–14.
b Estimated.
c Dry: July 15 to September 23.

Rating table for Santa Ynez River near Santa Barbara, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	0.4	2.35	14.7	2.90	82	3.60	306
2.05	1.6	2.40	18.5	3.00	103	3.70	353
2.10	2.8	2.45	23	3.10	126	3.80	401
2.15	4.5	2.50	28	3.20	154	3.90	451
2.20	6.4	2.60	38	3.30	186	4.00	502
2.25	8.8	2.70	50	3.40	222		
2.30	11.6	2.80	65	3.50	263		

Estimated monthly discharge of Santa Ynez River near Santa Barbara, Cal., for 1904.

[Drainage area, 207 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January 7–31	6.4	0.5	0.9	45	0.004	0.004
February	131.0	.6	12.0	690	.058	.063
March	445.0	2.3	30.2	1,857	.146	.168
April	121.0	6.0	18.9	1,125	.091	.102
May	18.5	2.6	6.8	418	.033	.038
June	2.6	.1	.7	42	.003	.003
July	.1	.0	.034	2	.000	.000
August	.0	.0	.000	0	.000	.000
September	5,450	.0	193.	11,484	.832	1.040
October	17.0	5.6	8.7	535	.042	.048
November	7.4	5.6	6.4	381	.031	.035
December	12.8	6.4	7.0	430	.034	.039
The period				17,009		

MONO CREEK AT MONO DAM SITE, CALIFORNIA.

This station was established November 22, 1902, by W. B. Clapp, assisted by Howard Rankin. It is located about one-half mile above the junction of Mono Creek and Santa Ynez River, 15 miles above the San Marcus ranch and 17 miles by trail from Santa Barbara. The river at this point traverses Mono flat. The gage is an inclined timber hewn from a 4-inch sapling. It is spiked to a willow tree on the right bank. The tree has been blazed above the gage for use in recording flood stages above the gage rod. Discharge measurements are

made by means of a cable and by wading. The cable is located about 500 feet below the dam site and is just above the gage. The initial point for soundings is a blaze at the base of the tree to which the cable is fastened on the left bank. The channel is slightly curved for about 500 feet above and below the station. Both banks are high and are not liable to overflow. The bed of the stream is composed of sandy gravel, free from vegetation, and is not liable to shift. The bench mark is a standard United States Geological Survey bench-mark disk on a sandstone rock 100 feet south of the large oak tree on the left bank. Its elevation is 20.92 feet above the zero of the gage and 1,410 feet above sea level. The record of the discharge, kept by means of a weir, from November 1 to December 31, 1903, showed a constant discharge for this period of 0.05 second-foot.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Mono Creek at Mono dam site, California, in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 28	R. L. North	1.89	30.0
February 29	do	1.41	3.5
March 11	do	1.90	32.0
March 12	do	1.48	8.0
March 13	do	1.35	2.6
March 14	do	1.33	2.3
March 25	do	1.71	18.2
March 27	do	1.52	8.2
March 29	do	1.48	7.9
April 1	do	1.52	8.1
April 3	do	1.43	4.1
April 19	do	1.95	34.0
April 20	do	1.77	19.4
April 21	do	1.64	9.7
April 24	do	1.45	5.4
April 25	do	1.42	4.0
April 26	do	1.63	8.9
April 27	do	1.63	8.8
April 29	do	1.62	8.2
May 1	do	1.46	6.4
May 5	do	1.43	4.2
May 7	do	1.32	2.1
May 9	do	1.32	2.0
May 11	do	1.32	2.0

Mean daily gage height, in feet, of Mono Creek at Mono dam site, California, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	(a)	.....	.....	1.52	1.46	(1.29)	(b)
2	.....	.....	.....	(1.47)	(1.47)	1.29	.....
3	.....	.....	.....	1.43	(1.48)	1.29	.....
4	.....	.....	.....	1.38	1.49	(1.29)	.....
5	.....	.....	.....	1.38	1.43	1.29	.....
6	.....	.....	.....	(1.38)	(1.37)	(1.29)	.....
7	.....	.....	.....	1.37	1.32	1.29	.....
8	.....	.....	.....	1.35	(1.32)	1.28	.....
9	.....	.....	.....	(1.35)	1.32	1.25	.....
10	.....	.....	.....	(1.35)	(1.32)	1.28	.....
11	.....	.....	1.90	(1.35)	1.32	1.28	.....
12	.....	.....	1.48	1.35	1.39	1.26	.....
13	.....	.....	1.35	1.35	(1.38)	1.26	.....
14	.....	.....	1.33	1.35	(1.38)	1.25	.....
15	.....	.....	(1.33)	1.35	1.37	1.25	.....
16	.....	.....	(1.32)	(1.35)	(1.37)	1.25	.....
17	.....	.....	(1.31)	1.36	1.36	1.25	.....
18	.....	.....	(1.30)	(1.36)	(1.35)	(1.25)	.....
19	.....	.....	.....	1.95	1.34	1.25	.....
20	.....	.....	.....	1.77	(1.34)	1.25	.....
21	.....	.....	.....	1.64	(1.35)	1.25	.....
22	.....	.....	.....	1.58	1.35	1.25	.....
23	.....	.....	.....	1.52	(1.34)	1.25	.....
24	.....	.....	2.21	1.45	1.33	1.25	.....
25	.....	.....	1.71	1.42	(1.34)	(1.25)	.....
26	.....	.....	(1.60)	1.63	1.35	(1.24)	.....
27	.....	3.05	1.52	1.63	1.34	(1.23)	.....
28	.....	1.89	(1.50)	(1.63)	(1.33)	1.22	.....
29	.....	1.41	1.48	1.62	(1.32)	1.21	.....
30	.....	.....	(1.50)	(1.60)	(1.31)	(1.21)	.....
31	.....	.....	1.52	.....	1.30	.....	.....

[a] Where gage heights are not given measurements were made over weir.
[b] Record stopped for the summer.

Gage heights in parenthesis are estimated.

Rating table for Mono Creek at Mono dam site, California, from January 1 to June 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.10	0.0	1.50	6.6	1.90	31	2.60	162
1.15	0.2	1.55	8.6	1.95	35	2.70	188
1.20	0.5	1.60	11.2	2.00	40	2.80	214
1.25	1.0	1.65	13.8	2.10	54	2.90	242
1.30	1.5	1.70	16.8	2.20	73	3.00	270
1.35	2.4	1.75	20	2.30	93	3.10	300
1.40	3.5	1.80	23.5	2.40	114	3.20	330
1.45	5.0	1.85	27	2.50	137		

Estimated monthly discharge of Mono Creek at Mono dam site, California, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	0.07	0.04	0.04	2	T.	T.
February	285	.03	11	633	0.09	0.10
March	76	.06	6.3	387	.05	.06
April	35	2.4	7.1	422	.06	.07
May	6.3	1.5	2.8	172	.02	.02
June	1.4	.6	1.1	65	.01	.01
The period				1,681		

MALIBU AND TRIUMFO CREEKS NEAR CALABASAS, CAL.

These stations were established at Chapman's ranch November 29, 1901, by S. G. Bennett. They are 40 miles from Los Angeles by wagon road and 8 miles southwest of Calabasas. Malibu Creek is formed by Triumfo and Las Virgines creeks, and is a short stream flowing through the Santa Monica Mountains and discharging into the Pacific Ocean about 15 miles above the city of Santa Monica, Cal. Sites for good storage reservoirs exist in both of these drainage basins, one on Malibu Creek a short distance below its gaging station, and one on Triumfo Creek above its gaging station. The water from these streams could be used for irrigation on the valuable land lying along the base of the mountains between the city of Los Angeles and Santa Monica, where it is greatly needed.

The channels of both streams are poor and subject to change during high water. They are located, however, at the only point where an observer could be secured. The excessive cost of visiting these stations has made it impossible to obtain as many meter measurements as desired, but the observer is instructed to take float velocities during floods at various gage heights, and these data, with cross sections and grade of stream, are used in addition to meter measurements for computing discharges for use in constructing rating curves and tables. The gage rods for both stations are vertical 2 by 6 inch wooden rods graduated to feet and tenths.

The gaging station on Malibu Creek is located about one-fourth mile below the mouth of Las Virgines Creek. The channel above the station is straight for about 600 feet, and below the station is curved for about 300 feet, and the water is swift. Both banks are high. The right bank is rocky, and the bed of the stream is composed of rock and gravel. The initial point for soundings is on the right

bank. The bench mark is a cross on a small projection on a rock bluff about 10 feet southwest of the gage rod. The assumed elevation of the bench mark is 530.00 feet. The zero of the gage rod is 524.57 feet elevation.

The gaging station on Triumfo Creek is about one-half mile above the mouth of Las Virgines Creek. The channel is straight for about 400 feet above and 800 feet below the station, and the water is swift. Both banks are high and rocky. The bed of the stream is composed of gravel and sand and is shifting. The initial point for soundings is on the right bank. The bench mark is a cross on a point of rock 3.5 feet above the bed of the creek. The assumed elevation is 550.00 feet. The zero of the gage rod is 545.47 feet elevation. The observer for both stations is J. G. Chapman.

The observations at these stations during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Mean daily gage height, in feet, of Malibu Creek near Calabasas, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Oct.	Nov.	Dec.
1	1.20	1.20	1.20	1.20	1.15	1.05	1.05	.....	1.00	1.15
2	1.20	1.20	1.20	1.20	1.15	1.05	1.05	.....	1.00	1.15
3	1.20	1.20	1.20	1.20	1.15	1.05	(a)	.....	1.00	1.20
4	1.20	1.20	1.20	1.20	1.15	1.05	.....	.....	1.00	1.20
5	1.20	1.20	1.20	1.10	1.15	1.05	.....	.....	1.00	1.20
6	1.20	1.20	1.20	1.10	1.15	1.05	.....	.....	1.00	1.20
7	1.20	1.20	1.20	1.10	1.15	1.05	.....	.....	1.00	1.20
8	1.20	1.20	1.20	1.05	1.15	1.05	.....	.....	1.00	1.20
9	1.20	1.20	1.20	1.00	1.15	1.05	.....	.....	1.00	1.20
10	1.20	1.20	1.60	1.00	1.15	1.05	.....	.....	1.00	1.20
11	1.20	1.20	1.45	1.05	1.10	1.05	.....	.....	1.00	1.20
12	1.20	1.20	1.25	1.05	1.10	1.05	.....	.....	1.00	1.20
13	1.20	1.20	1.15	1.05	1.10	1.05	.....	.....	1.00	1.20
14	1.20	1.20	1.15	1.05	1.05	1.05	.....	.....	1.00	1.20
15	1.20	1.20	1.15	1.05	1.05	1.05	.....	1.00	1.00	1.20
16	1.20	1.30	1.15	1.05	1.05	1.05	.....	1.00	1.00	1.20
17	1.20	1.25	1.15	1.05	1.05	1.05	.....	1.00	1.00	1.20
18	1.20	1.25	1.15	1.05	1.05	1.05	.....	1.00	1.00	1.20
19	1.20	1.20	1.15	1.15	1.05	1.05	.....	1.00	1.00	1.20
20	1.20	1.20	1.15	1.15	1.05	1.05	.....	1.00	1.00	1.20
21	1.20	1.20	1.15	1.15	1.00	1.05	.....	1.00	1.00	1.20
22	1.20	1.20	1.15	1.15	1.00	1.05	.....	1.00	1.00	1.20
23	1.20	1.20	1.50	1.15	1.00	1.05	.....	1.00	1.00	1.20
24	1.20	1.20	1.25	1.15	1.00	1.05	.....	1.00	1.00	1.20
25	1.20	1.20	1.20	1.15	1.00	1.05	.....	1.00	1.00	1.20
26	1.20	1.20	1.20	1.15	1.00	1.05	.....	1.00	1.00	1.20
27	1.20	1.25	1.20	1.15	1.00	1.05	.....	1.00	1.10	1.20
28	1.20	1.20	1.20	1.15	1.05	1.05	.....	1.00	1.10	1.20
29	1.20	1.20	1.20	1.15	1.05	1.05	.....	1.00	1.10	1.20
30	1.20	.....	1.20	1.15	1.05	1.05	.....	1.00	1.15	1.20
31	1.20	.....	1.20	.....	1.05	.....	.....	1.00	.....	1.20

a July 3, record stopped for summer.

Rating table for Malibu Creek near Calabasas, Cal., from March 31, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	1	1.70	44	2.40	265	3.10	720
1.10	2	1.80	57	2.50	330	3.20	785
1.20	5	1.90	72	2.60	395	3.30	850
1.30	10	2.00	95	2.70	460	3.40	915
1.40	16	2.10	128	2.80	525	3.50	980
1.50	24	2.20	165	2.90	590		
1.60	33	2.30	210	3.00	655		

Estimated monthly discharge of Malibu Creek near Calabasas, Cal., for 1904.

[Drainage area, 97 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	5	5	5.0	307	0.05	0.06
February	10	5	5.5	316	.06	.06
March	33	4	6.9	424	.07	.08
April	5	1	3.0	179	.03	.03
May	4	1	2.2	135	.02	.02
June	1.5	1.5	1.5	89	.02	.02
October 15–31	1	1	1.0	[a] 61	.01	.01
November	4	1	1.2	71	.01	.01
December	5	4	4.9	301	.05	.06
The period				1,883		

[a] Mean for 17 days taken as mean for month.

Mean daily gage height, in feet, of Triumfo Creek near Calabasas, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.
1	0.45	0.45	0.45	0.45	0.40
2	.45	.45	.45	.40	.40
3	.45	.45	.45	.40	.40
4	.45	.45	.45	.40	.40
5	.45	.55	.45	.40	.40
6	.45	.50	.45	.40	.40
7	.45	.50	.45	.40	.40
8	.45	.45	.40	.35	.40
9	.45	.45	.40	.30	.35
10	.45	.45	1.00	.30	.35
11	.45	.45	.80	.30	.30
12	.45	.45	.50	.30	.25
13	.45	.45	.45	.30	.20
14	.45	.45	.45	.35	.15
15	.45	.55	.45	.40	.15
16	.45	.65	.45	.40	.10
17	.45	.60	.45	.45	.10
18	.45	.60	.45	.45	.10
19	.45	.55	.45	.50	.10
20	.45	.50	.45	.40	.10
21	.45	.50	.45	.40	[a].00
22	.45	.50	.45	.40	.....
23	.45	.50	.90	.40	.....
24	.45	.50	.60	.40	.....
25	.45	.50	.55	.40	.....
26	.45	.50	.50	.40	.....
27	.45	.60	.50	.40	.....
28	.45	.50	.50	.40	.....
29	.45	.50	.45	.40	.....
30	.45	.....	.45	.40	.....
31	.45	.....	.45	.....	.....

[a] Stream entirely dry for remainder of the year.

Rating table for Triumfo Creek near Calabasas, Cal., from March 31, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.30	0.5	0.9	19	1.50	101	2.10	373
.40	2	1.00	26	1.60	129	2.20	450
.50	4	1.10	35	1.70	162	2.30	550
.60	6	1.20	46	1.80	200	2.40	670
.70	9	1.30	60	1.90	250		
.80	14	1.40	78	2.00	305		

Estimated monthly discharge of Triumfo Creek near Calabasas, Cal., for 1904.

[Drainage area, 72 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	3	3	3	184	0.04	0.05
February	8	3	4.1	236	.06	.06
March	26	2	4.8	295	.07	.08
April	4	0.5	1.8	107	.02	.02
May	2	0	.6	37	.01	.01
The period				859		

SAN GABRIEL RIVER AND CANALS NEAR AZUSA, CAL.

Owing to the numerous diversions it has been difficult to obtain accurate discharge measurements at Azusa; but during 1898 the San Gabriel Electric Company completed its system, and measurements are now obtained with greater ease and hence with greater accuracy. The headworks of this company are located about 6 miles above the mouth of the canyon; the water is carried along the left side by a series of tunnels and conduits, and a head of 400 feet is obtained where the electric power is generated. Weirs are placed on the conduit of the electric company, and the water is measured at this point. The capacity of the conduit is 80 second-feet.

The cable and gage are located about 1 mile from Azusa. During the season of low water for a period of from six to eight months the canals above the station divert the entire flow, and there is no running water at the station. The gage is a vertical 4 by 4 inch timber. Discharge measurements are made by means of a cable. The channel is straight for 150 feet above and for 500 feet below the cable, and has a width of 280 feet at high water. At low stages there are two channels having different elevations, and accurate measurements are difficult to obtain. The bed of the stream is composed of cobblestones and bowlders, and the current is swift.

The total flow of the river is obtained by adding the daily discharge for the river to the figures for the corresponding dates for the canals. The observer is H. F. Parkinson.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurement of San Gabriel River and canals near Azusa, Cal., for 1904.

Date.	Hydrographer.	Gage height.	Discharge.	Remarks.
		Feet.	*Second-feet.*	
March 18	E. C. Murphy	00	00	River.
	W. B. Clapp	Weir.	43	Canal.
			43	Total.
April 8	W. B. Clapp	1.30	14	River.
		Weir.	68	Canal.
			82	Total.
April 19	W. B. Clapp	1.58	38	River.
	R. P. Webb	Weir.	66	Canal.
			104	Total.

Mean daily gage height, in feet, of San Gabriel River near Azusa, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.
1	[a] 0.00	0.00	1.30	1.70	1.50
2	.00	.00	1.10	1.60	1.50
3	.00	.00	[a] .00	1.55	1.45
4	.00	.00	.00	1.50	1.40
5	.00	.00	.00	1.40	1.40
6	.00	.00	.00	1.40	1.35
7	.00	.00	.00	1.35	1.30
8	.00	.00	.00	1.30	1.25
9	.00	.00	.00	1.20	1.20
10	.00	.00	.00	1.10	1.15
11	.00	.00	1.85	.90	1.10
12	.00	.00	1.20	.75	1.00
13	.00	.00	.90	[a] .00	.80
14	.00	.00	[a] .00	.00	[b] .00
15	.00	.00	.00	.00	.00
16	.00	.00	.00	.00	.00
17	.00	.00	.0	.00	.00
18	.00	.00	.0	.00	.00
19	.00	.00	.00	1.65	.00
20	.00	.00	.00	1.70	.00
21	.00	.00	.00	1.50	.00
22	.00	.00	.00	1.40	.00
23	.00	.00	1.15	1.35	.00
24	.00	.00	2.40	1.30	.00
25	.00	.00	2.00	1.20	.00
26	.00	.00	1.80	1.50	.00
27	.00	.00	1.70	1.45	.00
28	.00	3.20	1.70	1.40	.00
29	.00	1.70	2.00	1.40	.00
30	.00	.....	1.90	1.40	.00
31	.00	.....	1.80	.....	.00

[a] River dry at rod: Jan. 1–Feb. 27; Mar. 3–10; Mar. 14–22; Apr. 13–18.
[b] River dry at rod remainder of the year. (See canals.)

Mean daily discharge, in second-feet, of San Gabriel canals near Azusa, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	24.0	23.0	47.0	66.0	67.0	38.0	18.0	10.0	11.0	10.5	12.5	15.0
2	24.0	23.5	51.5	66.0	67.0	36.5	17.5	9.5	10.8	9.0	12.5	15.3
3	24.0	23.5	47.0	66.0	67.0	35.5	17.0	10.0	10.5	10.0	12.5	15.3
4	24.0	23.5	42.0	66.0	67.0	32.5	17.0	10.0	10.5	10.0	12.5	15.3
5	24.0	59.0	40.0	66.0	67.0	32.0	16.5	10.0	10.0	11.0	12.5	15.3
6	23.5	37.0	38.0	66.0	67.0	31.0	16.0	10.0	9.0	12.0	12.5	14.7
7	23.3	31.5	37.5	66.0	67.0	30.0	16.0	12.0	8.5	12.5	12.5	15.2
8	24.0	31.0	35.5	68.0	67.0	30.0	15.7	12.7	7.5	15.0	12.0	15.3
9	24.5	30.0	35.0	68.0	67.0	29.0	15.5	11.5	8.5	15.5	11.0	16.0
10	24.5	30.0	35.5	68.0	67.0	28.0	15.0	11.5	9.5	15.5	11.0	16.0
11	24.5	30.0	60.0	68.0	67.0	26.5	13.8	11.0	9.5	15.5	11.5	16.0
12	24.0	28.0	60.0	68.0	66.0	25.2	14.0	10.0	9.5	14.5	12.0	16.0
13	24.0	28.0	56.0	66.0	65.0	25.2	14.3	29.0	12.5	13.5	12.5	16.0
14	23.5	28.0	51.0	64.0	64.0	23.0	15.5	15.0	11.5	13.0	12.5	16.0
15	23.5	28.0	49.0	64.0	61.0	24.0	15.0	14.5	11.0	13.5	12.5	16.0
16	23.5	40.0	46.0	61.0	59.0	23.0	15.0	14.0	10.0	13.5	12.5	16.0
17	23.5	41.0	44.5	58.0	56.0	22.5	14.0	14.0	11.0	12.0	12.6	16.0
18	28.2	38.0	42.6	57.0	55.0	22.0	14.0	13.7	12.0	11.5	13.3	16.0
19	27.4	34.5	41.5	66.0	53.0	22.0	13.0	13.7	12.0	10.5	13.0	16.0
20	27.4	33.0	50.0	66.0	51.0	22.0	12.5	13.7	12.0	9.5	13.5	15.5
21	25.5	31.4	48.0	66.0	49.0	25.0	11.8	13.5	12.0	10.0	13.5	15.7
22	25.2	30.8	46.0	66.0	48.0	23.0	12.0	15.0	12.0	10.5	13.5	16.3
23	24.6	30.0	62.0	67.0	44.5	23.0	12.0	15.0	11.0	11.0	13.5	16.8
24	24.5	29.5	62.0	67.0	44.5	23.0	11.1	14.5	12.0	11.0	13.0	17.0
25	24.5	29.5	62.0	67.0	46.0	22.0	11.0	14.5	12.7	11.0	13.0	16.7
26	24.5	29.5	62.0	67.0	51.0	19.0	11.0	13.0	13.5	11.5	13.5	16.0
27	24.0	30.0	62.0	67.0	46.5	18.5	12.0	12.5	12.5	11.5	14.0	16.7
28	23.5	00.0	62.0	67.0	40.0	18.5	11.5	11.5	12.0	11.5	14.0	16.5
29	23.5	38.0	66.0	67.0	40.0	18.5	12.0	11.3	10.5	12.0	14.5	16.0
30	23.5	.....	66.0	67.0	37.0	17.5	12.0	11.0	10.5	12.5	14.5	16.0
31	23.0	.....	66.0	.....	38.0	.....	11.0	11.0	.....	12.5	.....	48.0

Rating table for San Gabriel River near Azusa, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.60	1	2.00	92	3.40	535	5.60	2,855
.70	2	2.10	107	3.50	590	5.80	3,180
.80	4	2.20	125	3.60	652	6.00	3,525
.90	7	2.30	144	3.70	720	6.20	3,890
1.00	10	2.40	164	3.80	792	6.40	4,275
1.10	13	2.50	186	3.90	867	6.60	4,683
1.20	18	2.60	211	4.00	945	6.80	5,120
1.30	24	2.70	240	4.20	1,110	7.00	5,580
1.40	30	2.80	273	4.40	1,295	7.20	6,072
1.50	37	2.90	310	4.60	1,500	7.40	6,610
1.60	45	3.00	350	4.80	1,728	7.60	7,205
1.70	54	3.10	393	5.00	1,980	7.80	7,870
1.80	65	3.20	438	5.20	2,254	8.00	8,600
1.90	78	3.30	485	5.40	2,549		

Estimated monthly discharge of San Gabriel River and canals near Azusa, Cal., for 1904.[a]

[Drainage area, 222 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	28.2	23	24.4	1,500	0.11	0.13
February	438	23	47.7	2,744	.21	.23
March	1,130	35	110.8	6,813	.50	.58
April	120	57	89.7	5,337	.40	.45
May	104	37	66.5	4,089	.30	.35
June	38	17.5	25.5	1,517	.11	.12
July	18	11.0	14.0	861	.06	.07
August	29	9.5	12.9	793	.06	.07
September	13.5	7.5	10.8	643	.05	.06
October	15.5	9.0	12.0	738	.05	.06
November	14.5	11.0	12.8	762	.06	.07
December	48	14.7	16.9	1,039	.08	.09
The year	1,130	7.5	37	26,836	.17	2.28

[a] Includes water in canals.

SAN LUIS REY RIVER NEAR PALA, CAL.

This station was established October 9, 1903, by W. B. Clapp. It is located at Sickler's mill, 4 miles above Pala, Cal. It is reached by driving from Fallbrook or Escondido, stations on the Southern California Railway, 18 and 25 miles distant, respectively. The gage is an inclined 2 by 4 inch rod, graduated to feet and tenths, spiked to tree stumps and stakes at the left bank of the river. It is read once each day by M. M. Sickler. Discharge measurements are usually made by wading. During high water they are made from a car suspended from a ¾-inch galvanized iron wire cable stretched across the river at the gage. The initial point for soundings is the base of the oak tree to which the left end of the cable is fastened. The channel is straight for about 800 feet above and for 2,000 feet below the station. The grade of the stream is 0.60 feet in 100 feet. The current is swift. The right bank rises abruptly about 15 feet beyond the oak tree to which the cable is fastened and is not liable to overflow. The left bank is low, but is not liable to overflow. It was once a portion of the river channel, but is now well above high-water marks. The bed of the stream is rocky in portions of the flood channel, but the low-water channel is clear of rocks. There is a considerable growth of small timber in the channel, but this has been cleared the entire width

of the cross section for a distance of 100 feet above and 50 feet below the station. This timber growth is not permanent, being washed out by floods every few years. The bench mark is a United States standard bronze-capped iron post set flush with the ground on the right bank of the river and the north side of the wagon road, and about 50 feet west from the line of the cable prolonged. Its elevation is 557 feet above mean sea level, and 26.98 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Mean daily gage height, in feet, of San Luis Rey River near Pala, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Sept.	Oct.	Nov.	Dec.
1	1.74	1.74	1.87	2.32	1.80	1.68	.....	.....	1.40	1.45
2	1.74	1.74	1.84	2.28	1.90	1.68	.....	.....	1.40	1.55
3	1.74	1.74	1.82	2.24	1.85	1.68	.....	.....	1.41	1.55
4	1.74	1.74	1.79	2.20	1.80	1.68	.....	.....	1.40	1.55
5	1.74	1.86	1.77	2.18	1.78	1.69	.....	.....	1.40	1.55
6	1.74	1.80	1.77	2.10	1.75	1.69	.....	.....	1.40	1.55
7	1.74	1.80	1.77	2.08	1.75	1.69	.....	.....	1.39	1.55
8	1.74	1.80	1.77	2.05	1.74	1.68	.....	.....	1.39	1.55
9	1.74	1.79	1.77	2.05	1.74	1.67	2.03	.....	1.39	1.55
10	1.74	1.78	1.77	2.05	1.73	1.67	.....	1.70	1.39	1.55
11	1.74	1.78	1.95	2.04	1.73	1.67	.....	1.52	1.39	1.55
12	1.74	1.78	1.82	2.00	1.72	1.66	.....	1.40	1.39	1.55
13	1.74	1.78	1.80	1.95	1.72	1.66	.....	1.40	1.39	1.50
14	1.74	1.78	1.77	1.90	1.72	1.65	.....	1.40	1.39	1.45
15	1.74	1.78	1.75	1.85	1.71	1.65	.....	1.40	1.39	1.40
16	1.74	1.80	1.75	1.80	1.71	1.64	.....	1.41	1.40	1.40
17	1.74	1.82	1.75	1.78	1.71	1.64	.....	1.40	1.41	1.40
18	1.75	1.80	1.75	1.78	1.71	1.65	.....	1.40	1.42	1.40
19	1.75	1.80	1.77	1.78	1.71	1.65	.....	1.40	1.43	1.40
20	1.75	1.80	1.82	1.85	1.71	1.66	.....	1.40	1.45	1.40
21	1.75	1.80	1.77	1.85	1.71	1.66	.....	1.40	1.45	1.40
22	1.75	1.79	1.77	1.80	1.71	1.65	.....	1.41	1.45	1.40
23	1.75	1.79	3.50	1.80	1.71	1.65	.....	1.40	1.45	1.45
24	1.75	1.78	2.61	1.80	1.71	1.65	.....	1.39	1.45	1.45
25	1.74	1.78	2.31	1.79	1.71	1.65	.....	1.39	1.45	1.45
26	1.74	1.78	2.22	1.82	1.70	1.66	.....	1.40	1.45	1.45
27	1.74	1.78	2.18	1.82	1.70	1.65	.....	1.39	1.45	1.45
28	1.74	1.78	2.10	1.80	1.70	1.65	.....	1.40	1.45	1.45
29	1.74	1.88	2.52	1.80	1.69	1.66	.....	1.41	1.45	1.45
30	1.74	.....	2.50	1.80	1.69	[a] 1.65	.....	1.41	1.45	1.45
31	1.74	.....	2.50	.....	1.68	.....	.....	1.40	.....	1.50

[a] Gage observations discontinued until October 10.

SANTA ANA RIVER NEAR MENTONE, CAL.

This station was established in June, 1896. It is located 5 miles northeast of Mentone, Cal., three-fourths of a mile below the head works of the Mentone Power Company's canal, and opposite the warm springs in the canyon.

The Edison Electric Company diverts the greater portion of the water of Santa Ana River above the gaging station, but also returns all of it above the station. They, however, allow only limited portions of the water to pass out of their conduits during certain hours of the day, holding back the water for the purpose of obtaining additional power when the greatest demand exists.

The Mentone Power Company's canal, formerly called the Santa Ana canal, diverts water above the station, all of which is returned below the point of measurement. During the low-water season the entire flow of the river is diverted by the canals. The gage is an inclined 4 by 6 inch timber fastened to a large bowlder on the left bank. The channel was deepened by a flood March 31, 1903, and the gage was accordingly lowered to reach low-water stages June 30, 1903. The gage is read once each day by A. Laird. Discharge measurements are made by means of a cable and car, 100 feet below the gage. The initial point for soundings is the bench-mark spike set in the north side of a cottonwood tree on the left bank, 30 feet west of the tree to which the cable is fastened. The channel is straight for 100 feet above and below the station, and has a width of 22 feet at low and 125 feet at high stages. The current is swift at all stages. At flood stages the velocity is so high that measurements can be made only by means of floats. The right bank is low and is liable to overflow at flood stages for about 100 feet. The left bank is low, but is not liable to overflow. Both banks are overgrown with alders. The bed of the stream is composed of firm sand and small bowlders; it is subject to considerable change during flood stages. The bench mark, which is also used as the initial point for soundings, is a spike in the north side of the cottonwood tree on the left bank, 30 feet west of the tree to which the cable is fastened. Its elevation is 7.29 feet above the zero of the gage.

The observations of this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Santa Ana River near Mentone, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.	Remarks.
		Feet.	*Second-feet.*	
January 29	W. B. Clapp	Weir	26	Mentone Power Co.'s canal; total for river.
March 4	do	1.15	21	River.
		Weir.	12	Mentone Power Co.'s canal.
			33	Total for river.
March 12	do	1.25	26	River.
		Weir.	17	Mentone Power Co.'s canal.
			43	Total for river.
March 22	W. B. Clapp E. C. Murphy	1.10	20	River.
		Weir.	19	Mentone Power Co.'s canal.
			39	Total for river.
April 20	W. B. Clapp	1.65	49	River.
		Weir.	19	Mentone Power Co.'s canal.
			68	Total for river.
April 21	do	1.38	24	River.
		Weir.	35	Mentone Power Co.'s canal.
			59	Total for river.
May 14	do	1.25	16	River.
		Weir.	20	Mentone Power Co.'s canal.
			36	Total for river.
May 28	do	1.40	21	River.
		Weir.	18	Mentone Power Co.'s canal.
			39	Total for river.
June 29	do	1.45	24	River.
		Weir.	22	Mentone Power Co.'s canal.
			46	Total for river.
September 21	do	.....	2	River.
		.....	56	Mentone Power Co.'s canal.
			58	Total for river.
November 11	E. C. La Rue	.83	1	River.
		Weir.	18	Mentone Power Co.'s canal.
			19	Total for river.

Rating table for Santa Ana River near Mentone, Cal., from January 1 to March 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.35	0	0.80	10	1.50	43	2.40	144
.40	1	.85	11	1.60	51	2.50	161
.45	2	.90	13	1.70	60	2.60	179
.50	3	.95	15	1.80	69	2.70	199
.55	4	1.00	16	1.90	79	2.80	221
.60	5	1.10	20	2.00	91	2.90	245
.65	6	1.20	24	2.10	102	3.00	280
.70	7	1.30	30	2.20	114		
.75	9	1.40	36	2.30	129		

Rating table for Santa Ana River near Mentone, Cal., from April 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.80	1	1.10	9	1.60	37	2.10	93
.85	1.5	1.20	12	1.70	47	2.20	106
.90	2	1.30	17	1.80	57	2.30	122
.95	3	1.40	23	1.90	68		
1.00	5	1.50	29	2.00	80		

Two tables were necessary on account of change in channel on April 1, 1904.

Estimated monthly discharge of Santa Ana River[a] near Mentone, Cal., for 1904.[b]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	28	24	26	1,599	0.14	0.16
February	94	26	33	1,898	.18	.19
March	280	28	64	3,935	.35	.40
April	106	36	53	3,154	.29	.32
May	48	34	41	2,521	.23	.27
June	50	37	44	2,618	.24	.27
July	52	37	45	2,767	.25	.29
August	56	35	46	2,828	.25	.29
September	58	40	50	2,975	.27	.30
October	56	22	48	2,951	.26	.30
November	22	17.7	20	1,190	.11	.12
December	23	18.4	20	1,230	.11	.13
The year	280	17.7	41	29,666	.22	3.04

[a] Estimated monthly discharge includes Mentone Power Company's canal.
[b] River received water from Bear Valley reservoir to October 31, 1904.

SANTA MARIA RIVER NEAR SANTA MARIA, CAL.

This station was established October 22, 1903, by W. B. Clapp. It is located near the ranch house on Dutard's ranch, 21 miles above Santa Maria, Cal., a station on the Pacific Coast Railway. It is reached by driving from Santa Maria. The gage is an inclined 2 by 6 inch timber graduated to feet and tenths and fastened to a rock ledge at the right bank. It is read once each day by Joseph A. Thompson. At low and medium water, discharge measurements are made with meter by wading. During high water, velocities are measured by means of floats. For this purpose two wires are stretched across the stream 254 feet apart. The measuring stations are marked on each wire. The initial points for soundings are blazes on the poplar trees on the left bank, to which the wires are attached. The channel is slightly curved for 300 feet above, and curved for 1,000 feet below the station. The water is swift at medium and flood stages. The rise in the channel above the upper wire is 0.40 foot in 100 feet, and below the upper wire it is 0.57 foot in 100 feet. The right bank is high and rocky, and not liable to overflow. The left bank is low, covered with scattering poplar trees, but not liable to overflow. The bed of the stream is composed of sand and gravel. A portion of the bed is covered with a light growth of low brush. The channel is not liable to much change. The bench mark is a spike driven, near the ground, into the south side of the poplar tree to which the upper wire is fastened on the left bank of the stream. Its elevation is 9.65 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Santa Maria River near Santa Maria, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 18	W. B. Clapp	2.65	15.5
March 12	J. A. Thompson	3.60	[a] 220
March 24	do	4.00	[a] 499

[a] Float measurements.

Mean daily gage height, in feet, of Santa Maria River near Santa Maria, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Oct.	Nov.	Dec.
1	2.30	2.38	2.60	2.63	2.20	1.80	3.95	2.50	2.53
2	2.30	2.38	2.57	2.60	2.20	1.80	3.50	2.50	2.55
3	2.30	2.38	2.55	2.45	2.20	1.80	3.50	2.50	2.57
4	2.30	2.38	2.50	2.30	2.18	1.80	3.50	2.50	2.60
5	2.30	2.50	2.45	2.27	2.15	1.80	3.50	2.51	2.60
6	2.30	2.50	2.40	2.20	2.15	1.80	3.50	2.51	2.62
7	2.30	2.50	2.38	2.15	2.15	1.80	3.65	2.50	2.62
8	2.30	2.50	2.36	2.11	2.15	1.80	3.80	2.49	2.63
9	2.30	2.45	2.35	2.05	2.10	1.80	3.83	2.49	2.61
10	2.30	2.43	2.35	2.05	2.05	1.80	3.85	2.49	2.60
11	2.30	2.41	2.70	2.05	2.00	1.80	3.90	2.51	2.63
12	2.30	2.41	3.60	2.05	2.00	1.80	3.50	2.54	2.65
13	2.30	2.50	3.00	2.05	2.00	1.80	3.00	2.55	2.66
14	2.30	2.40	3.40	2.05	1.90	1.80	2.50	2.55	2.68
15	2.30	2.48	2.80	2.05	1.90	1.80	2.49	2.54	2.68
16	2.30	3.10	2.65	2.05	1.87	1.80	2.48	2.54	2.68
17	2.30	2.70	2.60	2.05	1.85	1.80	2.48	2.53	2.68
18	2.40	2.65	2.50	2.05	1.80	1.80	2.48	2.53	2.69
19	2.40	2.60	2.40	2.20	1.80	1.80	2.47	2.53	2.68
20	2.40	2.58	2.50	2.40	1.85	1.80	2.46	2.53	2.69
21	2.40	2.50	2.45	2.30	1.85	1.80	2.46	2.53	2.70
22	2.40	2.50	2.43	2.30	1.85	1.80	2.45	2.53	2.70
23	2.39	2.48	3.00	2.20	1.85	1.80	2.45	2.53	2.71
24	2.38	2.45	2.80	2.20	1.85	1.80	2.45	2.53	2.70
25	2.39	2.40	3.00	2.20	1.85	1.80	2.45	2.53	2.71
26	2.38	2.40	2.70	2.30	1.85	1.80	2.46	2.53	2.72
27	2.38	2.40	2.75	2.40	1.82	1.80	2.48	2.53	2.72
28	2.38	2.80	2.60	2.35	1.80	1.80	2.48	2.53	2.70
29	2.38	2.60	2.90	2.20	1.80	1.80	2.49	2.53	2.70
30	2.38	.....	2.70	2.20	1.80	1.80	2.50	2.53	2.70
31	2.38	.....	2.60	.....	1.80	(a)	2.50	.....	3.00

a No gage record during July, August, and September.

Rating table for Santa Maria River near Santa Maria, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.75	0.0	2.20	3	2.90	40	3.60	220
1.80	.2	2.30	5	3.00	53	3.70	265
1.85	.3	2.40	7	3.10	70	3.80	325
1.90	.5	2.50	10	3.20	90	3.90	400
1.95	.7	2.60	13	3.30	115	4.00	500
2.00	1	2.70	18	3.40	140		
2.10	2	2.80	27	3.50	175		

Estimated monthly discharge of Santa Maria River near Santa Maria, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	7	5	5.9	363
February	70	7	12.2	702
March	220	6	28.2	1,734
April	14	1.5	4.0	238
May	3	.2	1.1	68
June	.2	.2	.2	12
October	450	8	109.0	6,702
November	12	10	10.7	637
December	53	11	17.3	1,064
The period				11,520

MOHAVE RIVER AT VICTORVILLE, CAL.

At Victorville, a station on the Atchison, Topeka and Santa Fe Railway, the river passes through a narrow gorge, locally known as The Narrows. This place has been under investigation as a possible dam site, and soundings for the depth of bed rock were made by the United States Geological Survey during the season of 1899. The greatest depth of bed rock was found to be 54 feet. The diamond drill showed the rock to be a fine granite. A more detailed account of this exploration will be found in the Twenty-first Annual Report, part 4. Above The Narrows the valley broadens into a large reservoir site, but as no surveys of it have been made the capacity is unknown. In order to determine the amount of water available for storage for this reservoir a gaging station was established February 27, 1899. The channel is in sand, which is constantly shifting. The rod readings are of little value during low stages. Between January 1, 1902, and May 3, 1902, the discharge varied from 47 to 67 cubic feet per second, though the gage reading was 0.9 for the entire time. At the latter date the rod readings were discontinued. The mean estimated discharge for each month has been obtained by averaging the discharge as obtained by meter measurements made during the month.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Mohave River at Victorville, Cal., in 1904.[a]

Date.	Hydrographer.	Discharge.	Date.	Hydrographer.	Discharge.
		Sec.-ft.			*Sec.-ft.*
January 7	P. H. Leahy	62	August 23	P. H. Leahy	42
January 16	do	67	August 26	do	35
January 23	do	58	August 30	do	33
January 28	do	45	September 3	do	36
January 30	do	62	September 6	do	36
February 7	do	57	September 9	do	34
February 15	do	62	September 15	do	31
February 20	do	52	September 17	do	33
February 29	do	54	September 20	do	32
March 5	do	68	September 26	do	39
March 14	do	51	September 30	do	34
March 28	do	60	October 4	do	41
April 6	do	49	October 7	do	47
April 16	do	41	October 11	do	49
April 25	do	42	October 15	do	49
April 30	do	40	October 18	do	48
May 8	do	46	October 22	do	53
May 16	do	48	October 25	do	51
May 23	do	51	October 28	do	52
May 31	do	44	November 1	do	54
June 6	do	43	November 4	do	48
June 14	do	40	November 8	do	47
June 21	do	30	November 11	do	49
June 27	do	37	November 15	do	47
June 28	W. B. Clapp	28	November 18	do	47
July 2	P. H. Leahy	36	November 22	do	51
July 12	do	29	November 25	do	52
July 15	do	30	November 29	do	53
July 18	do	32	December 2	do	53
July 22	do	32	December 6	do	53
July 26	do	40	December 9	do	66
July 29	do	34	December 13	do	70
August 2	do	34	December 16	do	56
August 5	do	31	December 20	do	59
August 9	do	32	December 23	do	59
August 12	do	33	December 27	do	59
August 16	do	31	December 30	do	58
August 19	do	46			

[a] Small flood discharge on March 23, of which measurement was not obtained on account of poor conditions. Estimated discharge 500 second-feet for short period. Stream soon assumed natural conditions.

Estimated monthly discharge of Mohave River at Victorville, Cal., for 1904.[a]

[Drainage area, 400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	67	45	60	3,689	0.15	0.17
February	62	52	57	3,279	.14	.15
March	68	51	58	3,566	.14	.16
April	55	40	45	2,678	.11	.12
May	51	41	47	2,890	.12	.14
June	44	28	38	2,261	.10	.11
July	40	29	33	2,029	.08	.09
August	46	31	35	2,152	.09	.10
September	39	31	34	2,023	.08	.09
October	54	36	48	2,951	.12	.14
November	54	47	50	2,975	.12	.13
December	70	53	59	3,628	.15	.17
The year	70	28	47	34,121	.12	1.57

[a] Daily discharge obtained by interpolation between discharge measurements.

MISCELLANEOUS DISCHARGE MEASUREMENTS IN SOUTHERN CALIFORNIA.

The following miscellaneous measurements were made in southern California drainage:

Miscellaneous discharge measurements in southern California.

SANTA MARIA RIVER DRAINAGE.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Aug. 25	W. B. Clapp	Sisquoc River	Sisquoc ranch	1.1
Oct. 23	do	do	do	0.0

VENTURA RIVER DRAINAGE.

1903.				
Sept. 19	W. B. Clapp	Ventura River	Ventura Light and Power Co. Upper diversion city supply.	7.0
Sept. 19	do	do	Below upper diversion	3.7
		Total river		10.7
Sept. 19	do	Power ditch	At old mill	3.3

Miscellaneous discharge measurements in southern California—Continued.

SANTA CLARA RIVER DRAINAGE.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
June 16	W. B. Clapp	Newhall ditch	Southern Pacific Rwy. bridge, 3 miles below Saugus.	1.7
Sept. 16	do	do	do	1.8
Apr. 30	do	Santa Clara River	Road crossing Newhall ranch.	8.0
June 16	do	do	do	6.2
Sept. 16	do	do	do	5.4
Apr. 30	do	San Francisquito Creek	do	2.0
June 16	do	do	do	2.4
Sept. 16	do	do	do	2.0
Apr. 30	do	Santa Clara River	Opposite head of Camulas ditch.	25.0
June 17	do	do	do	21.1
		Camulas ditch	At head	7.6
		Total Santa Clara River.		28.7
Sept. 16	do	Santa Clara River	Camulas ditch	5.1
		Camulas ditch	At head	11.6
		Total Santa Clara River.		16.7
May 3	do	Santa Clara River	1 mile above Santa Paula.	127.0
June 22	do	do	do	22.0
		Richardson ditch	do	4.2
		Grees ditch	do	11.0
		Farmer's ditch	do	7.8
		Total Santa Clara River.		45.0
July 16	do	Santa Clara River	1 mile above Santa Paula.	23.4
		Richardson ditch	do	2.3
		Grees ditch	do	5.8
		Farmer's ditch	do	8.4
		Total Santa Clara River.		39.9
Aug. 13	J. B. Lippincott and G. S. Power.	Santa Clara River	1 mile above Santa Paula.	20.8
		Richardson ditch	do	1.2
		Grees ditch	do	11.1
		Farmer's ditch	do	8.6
		Total Santa Clara River.		41.7

Miscellaneous discharge measurements in southern California—Continued.

SANTA CLARA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge
1903.				*Second-ft.*
Sept. 18	W. B. Clapp	Santa Clara River	1 mile above Santa Paula.	18.2
		Richardson ditch	do	1.2
		Grees ditch	do	7.4
		Farmer's ditch	do	8.6
		Total Santa Clara River.		35.4
July 15	W. B. Clapp and G. S. Power.	Santa Clara Water and Irrigation Co.'s canal.	At head	30
July 16	do	do	do	33
Aug. 14	J. B. Lippincott and G. S. Power.	do	do	31.6
		Santa Clara River	Below head of canal	3.3
		Total river		34.9
Sept. 18	W. B. Clapp	Santa Clara Water and Irrigation Co.'s canal.	Heading	26.7
		River	Below canal heading	3.9
		Total river		30.6
May 1	do	Piru Creek	Dunton ranch	57
		do	Southern Pacific Rwy. bridge.	55
June 17	do	do	Upper diversion Piru Land and Water Co.	1.8
		do	1 mile above Esperanza.	3.9
		Total Piru Creek		5.7
Sept. 17	do	Upper diversion	1 mile above Esperanza.	1.2
		Lower diversion	Southern Pacific Rwy. bridge.	1.0
		Piru Creek	do	.1
		Total Piru Creek		1.1
June 17	do	Lower diversion	Southern Pacific Rwy. bridge.	3.7
		Piru Creek	do	2.7
		Total Piru Creek		6.4

Miscellaneous discharge measurements in southern California—Continued.

SANTA CLARA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
May 2	W. B. Clapp	Sespe Creek	Southern Pacific Rwy. bridge.	89
Sept. 17	do	Sespe Land and Water Co's. canal.	½ mile below head	4.6
		Sespe Creek	Below canal heading	.1
		Total Sespe Creek.		4.7
May 3	do	Santa Paula Creek	5 miles above Santa Paula.	28
		do	At Santa Paula	19.0
		Santa Paula Water Co's. ditch.	At Heading	5.6
June 22	do	do	do	10.1
Sept. 18	do	do	do	2.7

SANTA YNEZ RIVER DRAINAGE.

1903.				
Apr. 11	Howard Rankin	Amagusa Creek	At mouth	6.2
Apr. 15	do	do	do	4.5
Apr. 21	do	do	do	7.6
Apr. 23	do	do	do	6.9
Apr. 28	do	do	do	6.3
Apr. 10	do	Blue Canyon Creek	do	11.1
Apr. 22	do	do	do	11.7
Apr. 29	do	do	do	6.3
Apr. 10	do	Trail Creek	do	1.4
Apr. 22	do	do	do	2.0
Apr. 11	do	Ruiz Creek	do	5.4
Apr. 15	do	do	do	4.3
Apr. 21	do	do	do	7.0
Apr. 23	do	do	do	5.7
Apr. 28	do	do	do	4.5

Miscellaneous discharge measurements in southern California—Continued.

SAN LUIS REY RIVER DRAINAGE.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Aug. 15	W. B. Clapp	San Louis Rey River	Dam site, Warner's ranch reservoir.	2.8
Aug. 14	do	do	Above head of Escondido canal.	.5
Aug. 16	do	do	Pala, Cal	1.1
Aug. 15	do	Sickler's canal	Sickler's ranch	2.1
Oct. 9	do	do	do	2.1

LOS ANGELES RIVER DRAINAGE.

1903.				
Apr. 9	J. C. Clausen	Pacoima Creek	Mouth of canyon	47
Apr. 18	do	do	do	98
May 5	do	do	do	24
June 5	W. B. Clapp	do	do	8.0
Sept. 26	do	do	do	0.0
Apr. 9	J. C. Clausen	do	Southern Pacific Rwy.	32
Apr. 19	do	do	do	57
May 5	do	do	do	16.0
June 5	W. B. Clapp	do	do	0.0
Apr. 18	J. C. Clausen	do	3¼ miles below Southern Pacific Rwy.	0.0
May 5	do	do	1½ miles below Southern Pacific Rwy.	0.0
Apr. 10	do	Little Tejunga Creek	Mouth of canyon	10.0
Apr. 17	do	do	do	27
May 5	do	do	do	4.0
June 4	W. B. Clapp	do	do	1.0
Sept. 26	do	do	do	0.0
Apr. 10	J. C. Clausen	Big Tejunga Creek	do	59
Apr. 17	do	do	do	157
May 5	do	do	do	37
June 4	W. B. Clapp	do	do	12.0
Sept. 26	do	do	do	.1
Apr. 9	J. C. Clausen	do	Southern Pacific Rwy.	2.0
Apr. 17	do	do	do	124
May 5	do	do	do	0.0
June 4	W. B. Clapp	do	do	0.0
Apr. 17	J. C. Clausen	do	1½ miles below Southern Pacific Rwy.	0.0
Mar. 25	J. F. Danforth	Los Angeles River	Los Feliz Bridge	109

Miscellaneous discharge measurements in southern California—Continued.

LOS ANGELES RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Apr. 8	J. C. Clausen	Los Angeles River	Los Feliz Bridge	37
Apr. 13	O. W. Peterson	do	do	28
Apr. 17	do	do	do	64
Jan. 28	C. A. Miller	do	Aliso Street Bridge	66
Apr. 11	J. C. Clausen	do	Ninth Street Bridge	20
Apr. 18	O. W. Peterson	do	do	106
Apr. 18	do	do	Boyle avenue	75
Apr. 18	do	do	Opposite Bell station	73
Apr. 20	do	do	Above junction of Rio Hondo.	25
Apr. 20	do	do	Below junction of Rio Hondo.	54
Apr. 20	O. W. Peterson	do	One-half mile above Compton and Clearwater road.	82
Apr. 20	do	do	Opposite Clearwater	53
Apr. 21	do	do	One-half mile above Cerritos road.	39
Apr. 21	do	do	1½ miles below Cerritos road.	77
Apr. 21	do	do	Opposite Seabright	78
Apr. 13	W. B. Clapp	Arroyo Seco	At mouth of canyon	24
Apr. 17	do	do	do	100
May 21	do	do	do	10.0
Apr. 13	do	do	At Devils Gate	17.0
May 21	do	do	do	2.0
May 21	do	do	1 mile below Devils Gate.	0.0
Apr. 13	do	do	At Sheep Corral Spring, Pasadena.	4.0
Apr. 17	do	do	do	80
Apr. 13	do	do	Garvanza wagon bridge.	0.0
Jan. 28	C. A. Miller	do	At Avenue 26, Los Angeles.	274
Mar. 25	J. F. Danforth	do	do	128
Apr. 17	O. W. Peterson	do	do	77

Los Angeles River at Los Angeles, Cal.

LOS ANGELES RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Discharge.	Remarks.
1904.		*Sec.-feet.*	
April 15	F. B. Cook	42.3	44-inch conduit.
		4.5	Main-supply ditch.
		46.8	Total diversion Los Angeles River.
May 25	W. B. Clapp	40.0	44-inch conduit.
	F. B. Cook	8.0	Main-supply conduit.
		48.0	Total diversion Los Angeles River.
June 18	F. B. Cook	29.2	44-inch conduit.
		10.8	Main-supply conduit.
		40.0	Total diversion Los Angeles River.
June 27	W. B. Clapp	34.2	44-inch conduit.
	E. C. LaRue	8.6	Main-supply conduit.
		3.7	River at Huron street.
		46.5	Total Los Angeles River.
June 24	F. B. Cook	31.7	44-inch conduit.
		8.6	Main-supply conduit.
		40.3	Total diversion Los Angeles River.
July 19	E. C. LaRue	33.1	44-inch conduit.
	F. B. Cook	10.2	Main-supply conduit.
		5.3	River at Huron street.
		48.6	Total Los Angeles River.
August 9	F. B. Cook	29.9	44-inch conduit.
		10.4	Main-supply conduit.
		40.3	Total diversion Los Angeles River.
August 18	E. C. LaRue	30.5	44-inch conduit.
	F. B. Cook	10.8	Main-supply conduit.
		3.6	River at Huron street.
		44.9	Total Los Angeles River.
September 7	F. B. Cook	29.7	44-inch conduit.
		10.4	Main-supply conduit.
		40.1	Total diversion Los Angeles River.

Los Angeles River at Los Angeles, Cal.—Continued.

LOS ANGELES RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Discharge.	Remarks.
1904.		*Sec.-feet.*	
September 20	E. C. LaRue	31.1	44-inch conduit.
		11.0	Main-supply conduit.
		3.4	River at Huron street.
		45.5	Total Los Angeles River.
October 20	do	31.9	44-inch conduit.
		11.6	Main-supply conduit.
		8.2	River at Huron street.
		51.7	Total Los Angeles River.
October 25	F. B. Cook	31.4	44-inch conduit.
		11.6	Main-supply conduit.
		43.0	Total diversion Los Angeles River.
November 18	E. C. LaRue, F. B. Cook	33.3	44-inch conduit.
		11.8	Main-supply conduit.
		8.4	River at Huron street.
		53.5	Total Los Angeles River.
December 28	E. C. LaRue	27.7	44-inch conduit.
		10.0	Main-supply conduit.
		22.2	River at Huron street.
		59.9	Total Los Angeles River.

Miscellaneous discharge measurements in southern California.

SAN GABRIEL RIVER DRAINAGE.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
Apr. 20	W. B. Clapp and J. C. Clausen.	Dalton Creek	At mouth of canyon	9.0
May 22	W. B. Clapp	do	do	2.7
Sept. 14	do	do	do	0.0
May 22	do	do	1 mile below mouth of canyon.	0.0
Apr. 20	do	do	Southern California Rwy.	0.0

Miscellaneous discharge measurements in southern California—Continued.

SAN GABRIEL RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Apr. 20	W. B. Clapp and J. C. Clausen.	San Dimas Creek	Mouth of canyon	19.0
May 22	W. B. Clapp	do	do	2.5
Sept. 14	do	do	do	0.0
Apr. 20	do	do	Base Line avenue	0.0
Apr. 18	do	Santa Anita Creek	Mouth of canyon	35.0
1903.				
May 23	W. B. Clapp	Santa Anita Creek	Mouth of canyon	10
		Baldwin diversion heading.		3
		Total creek		13
Sept. 9	do	Baldwin diversion heading.		1.4
1902.				
July 29	J. A. Worthen	Baldwin ditch	Point (1)	3.2
Aug. 18	do	do	do	3.7
Sept. 8	do	do	do	.91
Sept. 27	do	do	do	2.0
Oct. 15	do	do	do	1.6
1904.				
June 15	J. A. Worthen	Baldwin ditch	Point (1)	3.0
July 8	do	do	do	3.4
Aug. 31	do	do	do	3.0
Sept. 24	do	do	do	2.8
Oct. 5	W. B. Clapp	do	do	2.9
Oct. 15	J. A. Worthen	do	do	[a] .2
1902.				
July 20	J. A. Worthen	Baldwin ditch	Point (3)	1.2
Aug. 18	do	do	do	.70
Sept. 8	do	do	do	.72
Sept. 27	do	do	do	.63
Oct. 11	do	do	do	.75
1904.				
June 15	J. A. Worthen	Baldwin ditch	Point (3)	1.4
June 8	do	do	do	.96
Aug. 31	do	do	do	.80

[a] Estimated. Main stream flowing through waste gate into old channel.

Miscellaneous discharge measurements in southern California—Continued.

SAN GABRIEL RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Sept. 24	J. A. Worthen	Baldwin ditch	Point (3)	0.94
Oct. 15	do	do	do	.78
1902.				
July 29	J. A. Worthen	Baldwin ditch	Point (4)	1.9
Aug. 18	do	do	do	1.2
Sept. 8	do	do	do	.99
Sept. 27	do	do	do	.52
Oct. 11	do	do	do	.81
1904.				
June 15	J. A. Worthen	Baldwin ditch	Point (4)	[a] .00
July 8	do	do	do	.00
Aug. 31	do	do	do	.62
Oct. 15	do	do	do	[b] .00
1903.				
Apr. 18	W. B. Clapp	Santa Anita Creek	Southern Pacific Railway, Monrovia Branch.	0
May 23	do	do	White Oak avenue	0
Apr. 18	do	Little Santa Anita Creek.	Above Santa Anita Creek.	5
Apr. 18	do	Eaton Canyon Creek	Mouth of canyon	29
May 21	do	do	do	3
		do	Water company's diversion at heading, mouth of canyon.	3
		Total creek		6
Sept. 9	do	Eaton Canyon Creek	Mouth of canyon	0
Apr. 18	do	do	At Southern California Railway.	0
May 21	do	do	1 mile above Southern California Railway.	0
Apr. 14	do	San Gabriel River	At upper road crossing, Duarte to Azusa.	264
May 26	do	do	Below head of Lexington wash.	29
		do	Diversion below head of Lexington wash.	37
		Total river at same place.		66

[a] No diversion. Ditch not kept up.

[b] No water used.

Miscellaneous discharge measurements in southern California—Continued.

SAN GABRIEL RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Apr. 15	W. B. Clapp	San Gabriel River	At El Monte Bridge	50
Apr. 15	do	do	Lexington wash at El Monte.	3
Apr. 26	O. W. Peterson	do	At El Monte Bridge	229
May 26	W. B. Clapp	do	do	0
Apr. 25	O. W. Peterson	do	At road crossing east of Durfee's ranch.	264
Apr. 25	do	do	Whittier road crossing	361
Apr. 24	do	do	Southern California Railway at Rivera.	365
Apr. 24	do	do	Southern Pacific Railway at Studebaker.	364
Apr. 23	do	do	Opposite Alamitos	311.
1902.				
Aug. 18	J. A. Worthen	Rio Hondo	Old Mission Bridge	24.3
Sept. 8	do	do	do	25.6
Sept. 27	do	do	do	21.5
Oct. 11	do	do	do	24.7
1903.				
Apr. 27	O. W. Peterson	Rio Hondo	Old Mission Bridge	36
Oct. 2	W. B. Clapp	do	do	29
1904.				
June 15	J. A. Worthen	Rio Hondo	Old Mission Bridge	22
July 8	do	do	do	24.1
Aug. 31	do	do	do	22.2
Sept. 24	do	do	do	21.7
Oct. 5	W. B. Clapp	do	do	22
Oct. 15	J. A. Worthen	do	do	27
1903.				
Apr. 27	O. W. Peterson	Rio Hondo	Whittier road crossing	17
Apr. 27	do	do	Road crossing west of Rivera.	12
Apr. 27	do	do	Southern Pacific Railway west of Downey.	12
Apr. 20	do	do	At S. P., L. A. & S.L. Railroad, above Workman.	29
Apr. 25	do	San Jose Creek	Whittier and Puente road.	8
Oct. 3	W. B. Clapp	Sheep Creek ditch	Whittier flume crossing.	4.6

Miscellaneous discharge measurements in southern California—Continued.

SAN GABRIEL RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1904.				*Second-ft.*
Oct. 5	W. B. Clapp	Sheep Creek ditch	Whittier flume crossing.	1.4
1903.				
Oct. 3	W. B. Clapp	Rincon ditch	Rincon road crossing	3.4
1904.				
Oct. 5	W. B. Clapp	Rincon ditch	Rincon road crossing	1.5
1903.				
Oct. 3	W. B. Clapp	Durfee ditch	Road crossing above ranch house.	1.6
1904.				
Oct 5	W. B. Clapp	Durfee ditch	Road crossing above ranch house.	0
1903.				
Oct. 2	W. B. Clapp	Los Nietos or Banta ditch.	At heading	28.0
1904.				
Oct. 5	W. B. Clapp	Los Nietos or Banta ditch.	100 feet below division box.	19.5
1903.				
Oct. 2	W. B. Clapp	Ranchito or Standeferd ditch.	At heading	14
1904.				
Oct. 5	W. B. Clapp	Ranchito or Standeferd ditch.	At heading	12.9
1903.				
Oct. 2	W. B. Clapp	Cate ditch	In flume at road crossing.	5.5
1904.				
Oct. 11	W. B. Clapp	Cate ditch	In flume at road crossing.	11.1
1902.				
July 25	J. A. Worthen	Arroyo ditch	At dam	21.7
1904.				
June 15	J. A. Worthen	Arroyo ditch	At dam	20.6
July 8	do	do	do	19.7
Aug. 31	do	do	do	18.6
Sept. 24	do	do	do	17.9
Oct. 15	do	do	do	20.8
1902.				
Sept. 27	J. A. Worthen	Arroyo ditch	At intake	24.6
Oct. 11	do	do	do	24.2

Miscellaneous discharge measurements in southern California—Continued.

SAN GABRIEL RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1904.				*Second-ft.*
June 21	W. B. Clapp and O. K. Parker.	Arroyo ditch	At intake	21.7
1902.				
Sept. 8	J. A. Worthen	Arroyo ditch	At Salt Lake Railway	19.6
Oct. 11	do	do	do	20.5
1904.				
June 15	J. A. Worthen	Arroyo ditch	At Salt Lake Railway	17.5
July 8	do	do	do	17.9
Aug. 18	do	do	do	20.6
Aug. 31	do	do	do	16.4
Sept. 24	do	do	do	17.0
Sept. 27	do	do	do	18.8
Oct. 15	do	do	do	18.5
June 21	W. B. Clapp and O. K. Parker.	do	do	19.4
1902.				
Aug. 18	J. A. Worthen	Arroyo ditch	At point of diversion	23.7
Sept. 8	do	do	do	23.2
1904.				
June 21	W. B. Clapp and O. K. Parker.	Arroyo ditch	At head of flume	16.7
Aug. 31	J. A. Worthen	do	do	16.2
Sept. 24	do	do	do	15.5
Oct. 10	do	do	do	18.6
1903.				
Apr. 25	J. B. Lippincott	Arroyo ditch	Southern California Railway, Rivera.	21
Oct. 3	W. B. Clapp	Whittier ditch	Pumping plant east of El Monte—developed water—discharge varies as needed.	5.1

SANTA ANA RIVER DRAINAGE.

1903.				
Apr. 1	W. B. Clapp	San Antonio Creek	Ontario Power Co.'s power house, mouth of canyon.	854
1904.				
Sept. 23	W. B. Clapp	San Antonio Creek	At power house, waste weir. Total creek.	6.4

Miscellaneous discharge measurements in southern California—Continued.

SANTA ANA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Apr. 21	W. B. Clapp and J. C. Clausen.	San Antonio Creek	At power house, mouth of canyon.	42
		do	San Antonio Water Co.'s diversion, mouth of canyon.	15
		Total creek		57
1903.				
May 25	W. B. Clapp	San Antonio Creek	At power house, mouth of canyon.	14
		do	San Antonio Water Co.'s diversion mouth of canyon.	20
		Total creek		34
July 3	do	San Antonio Creek	At power house, mouth of canyon. Total creek.	19.5
Sept. 13	do	do	do	11
Apr. 21	W. B. Clapp and J. C. Clausen.	do	1 mile below Southern Pacific Rwy.	.0
May 25	W. B. Clapp	do	Southern Pacific Rwy.	.0
Apr. 21	W. B. Clapp and J. C. Clausen.	Cucamonga Creek	Mouth of canyon	15
May 25	W. B. Clapp	do	do	5.5
1904.				
Sept. 23	W. B. Clapp	Cucamonga Creek	At point of diversion of Cucamonga Water Co.	1.8
1903.				
Sept. 13	W. B. Clapp	Cucamonga Creek	Above head works Hermosa Water Co.	3.6
Apr. 21	W. B. Clapp and J. C. Clausen.	do	Southern California Rwy.	.0
May 25	W. B. Clapp	do	Base line avenue	.0
Apr. 1	do	Lytle Creek	At mouth of canyon	1,790
Apr. 22	W. B. Clapp and J. C. Clausen.	do	do	56
		Rialto canal	Weir at head works	7
		Total creek		63

Miscellaneous discharge measurements in southern California—Continued.

SANTA ANA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
May 19	W. B. Clapp	Lytle Creek	Mouth of canyon	14.6
		Rialto canal	Weir at head works	14.9
		Total creek		29.5
July 2	do	Lytle Creek	Weir at head works Rialto canal. Total creek.	16.5
Sept. 12	do	do	do	14.7
1904.				
Sept. 22	W. B. Clapp	Lytle Creek	At mouth of canyon. Total creek.	9.2
1903.				
Apr. 22	W. B. Clapp	Lytle Creek	Highland avenue	.0
May 19	do	do	do	.0
Apr. 23	W. B. Clapp and J. C. Clausen.	West Twin Creek	Mouth of canyon	8.6
May 18	W. B. Clapp	do	do	2.1
		do	Ditch diversion	2.3
		Total creek		4.4
Sept. 11	do	West Twin Creek	Mouth of canyon. Total creek.	0.3
1904.				
Sept. 21	W. B. Clapp	West Twin Creek ditch	Head of pipe line	0.4
1903.				
Apr. 23	W. B. Clapp	West Twin Creek	Southern California Rwy.	.0
May 18	do	do	1 mile above Southern California Rwy.	.0
Apr. 23	W. B. Clapp and J. C. Clausen.	East Twin Creek	Mouth of canyon	10.0
May 17	W. B. Clapp	do	do	3.2
		do	Ditch diversion	1.6
		Total creek		4.8
Sept. 11	do	East Twin Creek	Ditch diversion. Total creek.	.4
1904.				
Sept. 22	W. B. Clapp	East Twin Creek	Wier at head of pipe line.	0.6

Miscellaneous discharge measurements in southern California—Continued.

SANTA ANA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Apr. 23	W. B. Clapp	East Twin Creek	1 mile above Southern California Rwy.	.0
May 17	do	do	do	.0
Apr. 23	W. B. Clapp and J. C. Clausen.	City Creek	Mouth of canyon	22
May 17	W. B. Clapp	do	do	4.4
		do	Canal diversion	6.8
		Total creek		11.2
Sept. 11	do	City Creek	Mouth of canyon. Total creek.	.2
1904.				
Sept. 22	W. B. Clapp	City Creek	Mouth of canyon. Total creek.	0.5
1903.				
Apr. 23	W. B. Clapp	City Creek	Road crossing south Harlem Springs.	.0
May 17	do	do	Base line avenue	.0
Apr. 23	W. B. Clapp and J. C. Clausen.	Plunge Creek	Mouth of canyon	23
May 17	W. B. Clapp	do	do	3
		do	Diversion mouth of canyon.	6
		Total creek		9
Sept. 11	do	Plunge Creek	Mouth of canyon. Total creek.	.6
1904.				
Sept. 21	W. B. Clapp	Plunge Creek	Above Highland canal.	0.6
1903.				
Apr. 23	W. B. Clapp	Plunge Creek	Orange avenue	.0
May 17	do	do	do	.0
1904.				
Mar. 22	W. B. Clapp and E. C. Murphy.	Mill Creek	Wier at Edison electric power house, Nos. 2 and 3.	17.6
Sept. 21	W. B. Clapp	do	do	14.1
Nov. 11	E. C. La Rue	do	do	11.2
1903.				
Apr. 1	W. B. Clapp	Mill Creek	Head of Crafton zanja.	1,280

Miscellaneous discharge measurements in southern California—Continued.

SANTA ANA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1904.				*Second-ft.*
Sept. 21	W. B. Clapp	Crafton zanja		15.2
Nov. 11	E. C. La Rue	do		14.1
1903.				
Apr. 24	W. B. Clapp and J. C. Clausen.	Mill Creek	Head of Crafton zanja	34
		Crafton zanja	do	5
		Total Mill Creek	do	39
May 16	W. B. Clapp	Mill Creek	do	19
		Crafton zanja	do	49
		Total Mill Creek	do	68
June 9	do	Mill Creek	do	2
		Crafton zanja	do	44
		Total Mill Creek	do	46
July 1	do	Crafton zanja	At head; total Mill Creek.	29
Sept. 1	do	do	do	22
Aug. 31	do	Morton Canyon	Mouth of canyon	.2
1904.				
May 28	W. B. Clapp	Morton Canyon	Mouth of canyon	.13
Sept. 21	do	do	do	.14
1903.				
Aug. 31	W. B. Clapp	Redlands tunnel	At outlet	1.8
1904.				
May 28	W. B. Clapp	Redlands tunnel	At outlet	1.59
June 29	do	do	do	1.55
Sept. 21	do	do	do	1.04
1903.				
Aug. 31	W. B. Clapp	Green Spot pipe line	Weir at head	6.3
1904.				
Jan. 29	W. B. Clapp	Green Spot pipe line	Weir at head	4.2
May 14	do	do	do	1.8
May 28	do	do	do	4.9
June 29	do	do	do	7.3
Sept. 21	do	do	do	6.0
Nov. 11	E. C. La Rue	do	do	1.1

Miscellaneous discharge measurements in southern California—Continued.

SANTA ANA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Apr. 24	W. B. Clapp	Highland canal	Weir at head	6
May 16	do	do	do	18
Aug. 31	do	do	do	15.6
1904.				
Jan. 29	W. B. Clapp	Highland canal	Weir at head	10.7
May 14	do	do	do	11.4
May 28	do	do	do	12.0
June 29	do	do	do	13.5
Sept. 21	do	do	do	16.4
Nov. 11	E. C. La Rue	do	do	7.8
1903.				
Apr. 24	W. B. Clapp	Redlands canal	Sand-box weir	9.6
May 16	do	do	do	29.0
Aug. 31	do	do	do	28.0
1904.				
Jan. 29	W. B. Clapp	Redlands canal	Sand-box weir	12.3
May 14	do	do	do	23.8
May 28	do	do	do	26.0
June 29	do	do	do	22.0
Nov. 11	E. C. La Rue	do	do	9.6
1903.				
Sept. 5	K. Sanborn	Castile ditch	1,000 feet below heading.	3
1904.				
May 15	K. Sanborn	Castile ditch	1,000 feet below heading.	.0
Aug. 18	do	do	do	.0
1903.				
Sept. 5	K. Sanborn	Wilbur ditch	At Rogers' pipe trestle crossing.	1.7
1904.				
May 15	K. Sanborn	Wilbur ditch	At Rogers' pipe trestle crossing.	2.54
Aug. 20	do	do	do	2.13
1903.				
Sept. 5	K. Sanborn	Newton ditch	West line section 28	4.1
1904.				
May 15	K. Sanborn	Newton ditch	West line section 28	4.7
Aug. 20	do	do	do	7.7

Miscellaneous discharge measurements in southern California—Continued.

SANTA ANA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
Sept. 5	K. Sanborn	Fuller ditch	At heading	13.4
1904.				
May 15	K. Sanborn	Fuller ditch	1 mile below intake	11.2
Aug. 20	do	do	do	4.6
1903.				
Sept. 5	K. Sanborn	Roberts ditch	At heading	2.6
1904.				
May 15	K. Sanborn	Roberts ditch	At heading	2.2
Aug. 20	do	do	do	1.4
1903.				
Sept. 23	W. B. Clapp	Newberry ditch	Auburndale Bridge	3.3
1904.				
May 15	K. Sanborn	Newberry ditch	Auburndale Bridge	.94
Aug. 20	do	do	do	2.7
1903.				
Sept. 23	W. B. Clapp	Durkee ditch	Auburndale Bridge	3.4
1904.				
May 15	K. Sanborn	Durkee ditch	Auburndale Bridge	.0
Aug. 20	do	do	do	.0
1903.				
Sept. 23	W. B. Clapp	Gilliland ditch	Auburndale Bridge	1.2
1904.				
May 15	K. Sanborn	Gilliland ditch	Auburndale Bridge	.61
Aug. 20	do	do	do	.42
1903.				
Apr. 30	O. W. Peterson	Santa Ana canal	1 mile below heading	43
Sept. 23	W. B. Clapp	do	do	34
Apr. 29	O. W. Peterson	Anaheim and Fullerton canal.	Heading	2.8
Sept. 25	W. B. Clapp	do	At Esperanza	32
Sept. 25	do	Yorba ditch	do	.6
May 15	W. B. Clapp and J. M. Mylne.	Santa Ana River	At Orange avenue	30
May 15	do	do	½ mile below Orange avenue.	.0
Apr. 22	W. B. Clapp and J. C. Clausen.	do	Colton Bridge	13

Miscellaneous discharge measurements in southern California—Continued.

SANTA ANA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
May 18	W. B. Clapp	Santa Ana River	Colton Bridge	.0
Sept. 23	do	do	Auburndale Bridge	58
Mar. 31	do	do	Rincon wagon bridge	400
Apr. 29	O. W. Peterson	do	do	193
May 18	W. B. Clapp	do	do	108
June 12	do	do	do	85
July 23	do	do	do	59
Aug. 19	do	do	do	60
Sept. 23	do	do	do	78
Oct. 30	do	do	do	93
Nov. 25	do	do	do	102
1904.				
Jan. 26	W. B. Clapp	Santa Ana River	Rincon wagon bridge	109
Feb. 29	do	do	do	162
Mar. 21	W. B. Clapp and E. C. Murphy.	do	do	107
Apr. 29	W. B. Clapp	do	do	96
May 23	do	do	do	82
June 20	W. B. Clapp and W. V. Hardy.	do	do	63
July 23	E. C. La Rue	do	do	62
Aug. 20	do	do	do	69
Sept. 20	W. B. Clapp	do	do	74
Sept. 28	E. C. La Rue	do	do	75
Oct. 22	do	do	do	73
Nov. 19	do	do	do	103
Dec. 10	do	do	do	110
1903.				
Apr. 29	O. W. Peterson	Santa Ana River	1 mile above heading of Santa Ana and Anaheim canals.	214
Sept. 23	W. B. Clapp	do	Heading Santa Ana and Anaheim canals.	72
1904.				
Sept. 28	E. C. La Rue	Santa Ana River	Heading Santa Ana and Anaheim canals.	66
1903.				
Apr. 29	O. W. Peterson	Santa Ana River	2 miles below heading Santa Ana and Anaheim canals.	185
Apr. 30	do	do	2 miles above Yorba	130
Apr. 30	do	do	½ mile above Yorba	141

Miscellaneous discharge measurements in southern California—Continued.

SANTA ANA RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Second-ft.*
May 1	O. W. Peterson	Santa Ana River	¾ mile above Southern California Rwy. crossing at Olive.	51
May 1	do	do	¾ mile below Southern California Rwy. crossing at Olive.	.0
Mar. 31	W. B. Clapp	Chino Creek	At Rincon wagon bridge.	146
Apr. 29	O. W. Peterson	do	do	23
May 18	W. B. Clapp	do	do	15
June 12	do	do	do	6.5
July 23	do	do	do	3.4
Aug. 19	do	do	do	2.4
Sept. 23	do	do	do	3.3
Oct. 30	do	do	do	6
Nov. 25	do	do	do	9.2
1904.				
Jan. 26	W. B. Clapp	Chino Creek	At Rincon wagon bridge.	14.7
Feb. 29	do	do	do	24
Mar. 21	W. B. Clapp and E. C. Murphy.	do	do	16.0
Apr. 29	W. B. Clapp	do	do	15.0
May 23	do	do	do	4.3
June 20	W. B. Clapp and W. V. Hardy.	do	do	2.0
July 23	E. C. La Rue	do	do	1.5
Aug. 20	do	do	do	1.6
Sept. 20	W. B. Clapp	do	do	2.8
Sept. 28	E. C. La Rue	do	do	3.6
Oct. 22	do	do	do	5.6
Nov. 19	do	do	do	8.3
Dec. 10	do	do	do	8.7

Weir measurements of San Antonio Creek at division dam, California, 1889–1891.

[Measurements by F. E. Trask.]

Date.	Discharge.	Date.	Discharge.
1889.	*Second-feet.*	1890.	*Second-feet.*
July 15	20.56	August 1	32.08
August 1	18.00	August 15	26.76
August 15	16.40	September 1	22.14
September 2	16.24	September 15	18.92
September 16	13.96	1891.	
October 1	13.32	July 15	20.10
October 17	13.94	August 1	16.67
November 2	23.70	August 15	16.26
December 2	33.02	September 13	12.26
1890.			
July 15	37.71		

Weir measurements at San Antonio Creek at division box, California, 1892–1903.

[Measurements by F. E. Trask.]

Date.	Discharge.	Date.	Discharge.
1892.	*Second-feet.*	1897.	*Second-feet.*
July 15	12.50	September 20	9.24
September 15	8.16	1898.	
November 19	7.09	July 5	5.24
1893.		August 1	4.72
August 14	14.30	September 5	4.24
August 30	12.72	1899.	
September 25	12.16	July 3	2.98
October 25	10.84	August 7	3.88
1894.		September 3	4.06
July 16	6.00	1900.	
1895.		July 1	4.36
July 15	18.48	August 6	3.54
August 22	16.78	September 1	3.22
September 7	14.20	1902.	
1896.		July 21	5.30
June 25	6.58	August 16	4.22
July 15	5.20	September 13	3.40
September 15	5.44	1903.	
1897.		August 10	9.40
July 6	17.24	August 16	7.66
August 16	10.82		

July 18, 1888, float measurement by F. E. Trask showed 22.12 second-feet discharge for entire creek above division. (Excludes Gurd water=0.4 second-feet. Gurd water purchased by the San Antonio Water Company, May, 1896, and diverted above division weir.)

Discharge measurements of San Antonio tunnel at the Portal, California, 1888–1904.

[Measurements by F. E. Trask.]

Date.	Discharge.
	Second-feet.
1888.	
April 2	4.84
April 15	2.32
October 10	.73
1889.	
January 10	1.61
May 31	1.33
June 17	1.26
July 15	.91
August 15	.61
September 2	.61
October 1	.57
November 2	.86
December 2	.81
1890.	
January 27	5.58
June 12	2.57
July 15	2.49
August 15	2.23
September 15	1.36
1891.	
July 15	4.93
August 15	3.55
September 15	2.74
1892.	
July 16	3.49
September 15	2.98
1893.	
July 15	5.03
1894.	
May 11	2.72
July 16	2.75
1895.	
July 15	1.79
August 22	1.53
September 7	1.45
1896.	
June 25	1.62
July 15	1.52
September 15	1.19
1897.	
January 25	1.93
July 19	2.08
August 2	1.72
September 6	1.32
1897.	
October 4	1.19
1898.	
March 16	1.30
April 4	1.30
May 4	1.21
June 6	1.42
July 5	1.23
August 1	1.12
September 5	1.06
October 2	.97
November 6	1.02
December 5	1.05
1899.	
January 3	1.08
May 1	1.09
July 3	.97
August 7	.95
December 31	1.24
1900.	
February 1	1.14
March 5	1.07
April 1	1.01
May 7	1.00
July 1	1.00
October 8	1.00
1902.	
June 28	1.35
July 5	1.32
August 2	1.19
September 6	1.14
October 4	1.08
1903.	
January 19	.92
March 16	1.29
April 24	4.86
July 29	1.51
August 24	1.25
October 6	.99
December 1	1.07
1904.	
January 22	1.07
February 8	1.07
April 6	2.32
May 28	1.60
June 4	1.47

Natural flow of return water to Santa Ana River, in second-feet, compared with developed water in San Bernardino Valley above Colton, Cal., 1903–4.

[Measurements by K. Sanborn, engineer Riverside Water Company.]

Date.	Location.	Developed.	Natural.	Total.
1903.		*Second-ft.*	*Second-ft.*	*Second-ft.*
September 9	Brown tract, artesian well	0.11		0.11
September 4	Barnhill pumping plant	.80		.80
1904.				
May 12	Barnhill pumping plant	.85		.85
August 15	do	.77		.77
1903.				
September 4	Bloomington pumping plant	8.82		8.82
1904.				
May 12	Bloomington pumping plant	.00		.00
August 17	do	5.61		5.61
1903.				
August 17	Beam ditch		0.08	.08
1904.				
June 4	Beam ditch		.02	.02
August 20	do		.00	.00
1903.				
September 4	City of Colton pumping plant	3.17		3.17
1904.				
May 12	City of Colton (total all pumps)	3.00		3.00
August 19	do	2.06		2.06
1903.				
September 7	Cooley tract, artesian well	2.70		2.70
August 22	Camp Carlton ditch	2.20		2.20
1904.				
June 4	Camp Carlton ditch	2.50		2.50
August 19	do	2.60		2.60
1903.				
September 9	Daley ditch		.00	.00
1904.				
June 4	Daley ditch		.00	.00
August 20	do		.00	.00
1903.				
August 18	Flume pump No. 1, Riverside Water Co.	4.08		4.08

Natural flow of return water to Santa Ana River, in second-feet, etc.—Continued.

Date.	Location.	Developed.	Natural.	Total.
1904.		*Second-ft.*	*Second-ft.*	*Second-ft.*
May 31	Flume pump No. 1, Riverside Water Co.	1.79	.....	1.79
July 29	do	2.99	.....	2.99
1903.				
August 18	Flume pump No. 2, Riverside Water Co.	2.63	.....	2.63
1904.				
May 31	Flume pump No. 2, Riverside Water Co.	1.76	.....	1.76
July 29	do	2.52	.....	2.52
1903.				
September 9	Garner tract, artesian well	.77	.....	.77
August 21	Gage canal diversion	.....	0.00	.00
1904.				
May 31	Gage canal diversion	.....	.00	.00
August 15	do	.....	.00	.00
1903.				
August 21	Gage canal, Palm avenue weir	30.82	.....	30.82
1904.				
May 31	Gage canal, Palm avenue weir	27.80	.....	27.80
August 19	do	31.96	.....	31.96
1903.				
September 9	Hurd tract, artesian wells	.21	.....	.21
September 4	H. T. Hunter pumping plant	1.79	.....	1.79
1904.				
June 2	H. T. Hunter pumping plant	1.82	.....	1.82
August 17	do	1.54	.....	1.54
1903.				
August 17	Haws & Talmadge ditch	.....	.00	.00
1904.				
May 13	Haws & Talmadge ditch	.....	.00	.00
August 15	do	.....	.00	.00
1903.				
September 4	Johnson & Hubbard pumping plant	.42	.....	.42
1904.				
June 2	Johnson & Hubbard pumping plant	.67	.....	.67
August 17	do	.39	.....	.39
1903.				
September 4	Lawson Well Co. pumping plant	.59	.....	.59

Natural flow of return water to Santa Ana River, in second-feet, etc.—Continued.

Date.	Location.	Developed.	Natural.	Total.
1904.		*Second-ft.*	*Second-ft.*	*Second-ft.*
June 12	Lawson Well Co. pumping plant	0.65		0.65
August 15	do	.50		.50
1903.				
September 4	Lamb pumping plant	.24		.24
1904.				
May 12	Lamb pumping plant	.25		.25
August 15	do	.25		.25
1903.				
August 22	Logsden & Farrell ditch		0.00	.00
1904.				
June 4	Logsden & Farrell ditch		.00	.00
August 3	do		.00	.00
1903.				
September 1	Meeks & Daley ditch		12.87	12.87
1904.				
May 31	Meeks & Daley ditch		16.30	16.30
August 3	do		16.75	16.75
1903.				
September 9	McIntyre ditch		.00	.00
1904.				
August 15	McIntyre ditch		.00	.00
1903.				
August 17	McKenzie ditch		.00	.00
1904.				
May 13	McKenzie ditch	.67		.67
August 12	do	.58		.58
1903.				
August 18	Riverside Water Co., mill flume		.00	.00
1904.				
May 31	Riverside Water Co., mill flume		2.68	2.68
July 29	do		.00	.00
1903.				
September 4	Orange Land and Water Co	1.08		1.08
1904.				
May 12	Orange Land and Water Co	1.14		1.14
August 17	do	1.12		1.12

Natural flow of return water to Santa Ana River, in second-feet, etc.—Continued.

Date.	Location.	Developed.	Natural.	Total.
1903.		*Second-ft.*	*Second-ft.*	*Second-ft.*
September 7	Rancheria pumping plant	1.09	.....	1.09
1904.				
May 12	Rancheria pumping plant	1.46	.....	1.46
August 17	do	1.30	.....	1.30
1903.				
September 1	Riverside Water Co., upper canal	23.89	32.01	55.90
1904.				
May 31	Riverside Water Co., upper canal	29.44	12.96	42.40
July 29	do	19.85	18.28	38.13
1903.				
September 4	Riverside Highland Water Co.'s pumping plant, Lytle Creek.	8.98	.....	8.98
1904.				
May 12	Riverside Highland Water Co.'s pumping plant, Lytle Creek.	7.92	.....	7.92
August 17	do	2.00	.....	2.00
May 12	Riverside Highland Water Co., Santa Ana River.	.00	.....	.00
August 19	do	6.43	.42	6.85
1903.				
August 17	Rabel dam ditch	.....	.00	.00
1904.				
May 13	Rabel dam ditch	.....	.00	.00
August 15	do	.....	.00	.00
1903.				
August 19	River ditch pump, Riverside Water Co.	5.79	.....	5.79
1904.				
May 21	River ditch pump (pumps Nos. 1 and 2)	9.33	.....	9.33
August 23	River ditch pump	9.14	.....	9.14
1903.				
August 19	C. W. Rogers pumping plant	4.44	.....	4.44
1904.				
May 31	C. W. Rogers pumping plant	.00	.....	.00
August 15	do	.00	.....	.00
1903.				
August 17	Shay & Stout ditch	.00	.....	.00
1904.				
May 13	Shay & Stout ditch	.00	.....	.00
August 15	do	.00	.....	.00

Natural flow of return water to Santa Ana River, in second-feet, etc.—Continued.

Date.	Location.	Developed.	Natural.	Total.
1903.		*Second-ft.*	*Second-ft.*	*Second-ft.*
September 7	Swamp ditch		0.42	0.42
1904.				
June 4	Swamp ditch		.51	.51
August 12	do		.47	.47
1903.				
September 9	Wozencraft tract, artesian well	0.23		.23
August 22	Whitlock ditch		.00	.00
1904.				
June 4	Whitlock ditch		.00	.00
August 20	do		.00	.00
1903.				
August 21	Ward & Warren ditch	1.44	.17	1.61
1904.				
June 4	Ward & Warren ditch		.00	.00
August 20	do		.00	.00
1903.				
August 17	Whiting ditch		.00	.00
1904.				
June 4	Whiting ditch		.00	.00
August 20	do		.00	.00
1903.				
August 19	West Riverside, 350-Inch Water Co	3.41		3.41
1904.				
May 21	West Riverside, 350-Inch Water Co	6.52		6.52
August 19	do	5.35		5.35
May 12	Merryfield pumping plant	.90		.90
August 5	do	.80		.80
May 12	Grand Terrace Pumping Co. pumping plant.	.34		.34
August 17	do	.34		.34
May 31	Riverside Water Co. mill pump, Colton	1.32		1.32
July 29	do	1.38		1.38
May 31	City of San Bernardino	.82	1.87	2.69
August 17	do	1.02	1.79	2.81
May 21	Rosedale Water Co	.60		.60
August 12	do	.50		.50
August 12	Carr pumping plant	.72		.72
August 17	Lytle Creek Water and Improvement Co	4.00		4.00
May 21	Mount Vernon Water Co		.91	.91
August 17	do		.91	.91

Return waters in San Bernardino Valley below Slover Mountain and above Riverside Narrows, 1903 and 1904.

[Measurements by K. Sanborn, engineer Riverside Water Company.]

Date.	Location.	Developed.	Natural.	Total.
1903.		*Second-ft.*	*Second-ft.*	*Second-ft.*
August 20	Alvitriz ditch at intake, West Riverside Bridge.	.....	3.10	3.10
1904.				
May 13	Alvitriz ditch at intake, West Riverside Bridge.	.....	1.63	1.63
August 8	do	.....	2.23	2.23
1903.				
August 21	Evans ditch No. 1 at intake, Riverside County line.	.....	.81	.81
1904.				
May 16	Evans ditch No. 1 at intake, Riverside County line.	.....	2.53	2.53
August 11	do	.....	.00	.00
1903.				
August 22	Evans ditch No. 2 at intake, 1 mile below Riverside County line.	.....	.70	.70
1904.				
May 16	Evans ditch No. 2 at intake, 1 mile below Riverside County line.	.....	2.03	2.03
August 11	do	.....	1.31	1.31
1903.				
August 20	Evans Island ditch under west end of West Riverside Bridge.	.....	4.71	4.71
1904.				
May 13	Evans Island ditch under west end of West Riverside Bridge.	.....	3.43	3.43
August 8	do	.....	.00	.00
June 2	Evans well ditch, Santa Ana street	0.51	.....	.51
August 8	do	.04	.....	.04
June 3	Evans pipe line to Chino Gardens, at headworks.	.....	1.41	1.41
August 8	do	.....	.00	.00
August 8	Evans pumping plant, 1,000 feet south of west end of West Riverside Bridge.	3.03	.....	3.03
August 18	Evans Jurupa pumping-plant weir, end of force main.	2.00	.....	2.00
1903.				
August 21	Lower canal Riverside Water Co., at head.	.....	2.05	2.05
1904.				
May 21	Lower canal Riverside Water Co., at head.	.....	3.15	3.15
August 11	do	.....	.39	.39

Return waters in San Bernardino Valley below Slover Mountain, etc.—Continued.

Date.	Location.	Developed.	Natural.	Total.
1903.		*Second-ft.*	*Second-ft.*	*Second-ft.*
August 21	Rubidoux canal at head	1.74	4.78	6.52
1904.				
May 16	Rubidoux canal at head		6.49	6.49
August 8	do		2.82	2.82
June 3	Ferris Gallagher ditch near head		1.72	1.72
August 8	do		1.71	1.71
June 3	Gallagher ditch near headworks		.86	.86
August 18	do		.92	.92
August 18	Cuttle's pumping-plant weir at end of force main.	2.45		2.45
June 3	Jurupa pumping plant to supply Rubidoux ditch.	.00		.00
August 11	do	4.35		4.35
May 16	Riverside Power Co.'s canal near River Narrows.		38.30	38.30
August 18	do		29.50	29.50
August 8	Soquel ditch		1.49	1.49
August 8	Spanishtown pumping-plant weir at end of force main.	3.22		3.22
August 8	Spring Brook pumping-plant weir at end of force main.		4.84	4.84
June 3	Zimmerman pipe line at intake, near dam.		.00	.00
August 8	do		1.08	1.08
1903.				
August 25	Santa Ana River at Narrows		40.70	40.70

SAN FRANCISCO BAY DRAINAGE BASIN.

Sacramento River, rising in northern California and flowing south, and San Joaquin River, rising in the southern Sierras and flowing northeast, drain the western slope of the Sierra Nevada, traverse what is often called the Valley of California, and meet near Suisum Bay, finally discharging their waters into the Pacific Ocean through San Francisco Bay.

Sacramento River derives its water supply largely from Mount Shasta and the surrounding high ranges in the extreme northern portion of California. The stream does not have the same regular annual fluctuations that characterize the rivers discharging from the higher Sierra Nevada, since a large part of its basin is not at an elevation sufficient to cause the winter snows to remain unmelted until the sum-

mer months. The greatest floods of this basin usually occur in January and February, when the snow is accompanied or followed by rain.

San Joaquin River is divided into two distinct parts. The valley portion forms the central drainage line of San Joaquin Valley, and during the spring is navigable for a hundred miles or more. Stanislaus, Tuolumne, and King rivers are the largest affluents of this portion of the stream. Its valley is fertile and almost destitute of timber. The mountainous portion of the stream drains the western slopes of the Sierra Nevada between Yosemite National Park and Mount Goddard, the crest of its divide reaching on the north an elevation of 13,000 feet in Mount Lyell, and an elevation of 14,000 feet in Mount Goddard. The resulting steep grades of this river offer exceptional opportunities for water-power developments, and the high elevations of the basin insure a well-sustained summer flow from perpetual snow banks.

The following streams are tributary to either Sacramento or San Joaquin rivers:

Cache Creek is the outlet of Clear Lake, in Lake County, Cal. Flowing southeasterly, its flood waters find their way into Sacramento River between the mouths of Feather and American rivers. In 1889 Clear Lake was segregated as a reservoir site, as described in the Thirteenth Annual Report, part 3, pages 405–409. During 1900 a hydrographic examination of the entire basin of Cache Creek was made by A. E. Chandler, whose detailed report has been published as Water-Supply Paper No. 45.

Feather River is the second largest tributary of Sacramento River, Pit River being the first. Its basin line follows the crest of the Sierra Nevada for about 130 miles. The rainfall in this basin is large; the mean for nineteen years at Mumfords Hill, Plumas County, is 71.64 inches; the rainfall for the year 1889–90 at this point reached 138.85 inches. The water collected by the river when rains are general sometimes causes tremendous freshets, usually of short duration. The river has at such times overtopped its right bank and overflowed the plain lands to the north of Sutter Buttes. This occurred even before the great reduction of waterway below the mouth of Yuba River. The channel of the river below its junction with the Yuba has become the repository of so much mining débris that its bed has become nearly filled. Its bottom is almost at the heights of its former banks, and levees have been built to prevent overflowing. Only a comparatively small portion of the summer flow of this stream is used for irrigation, though the possibilities of irrigation and power development are great.

There are some excellent reservoir sites on the upper tributaries of the North Fork of the Feather. This stream is fed in part by large

springs, one of which, in Big Meadows, was flowing 109 cubic feet per second in September, 1902, and another 64 cubic feet per second.

Stony Creek drains 760 square miles of the eastern slopes of the Coast Range. After reaching the Sacramento Valley it flows north for a number of miles, contrary to the general drainage, and then turns east and enters Sacramento River below Vina, Cal. A large portion of the basin near the heads of the stream is heavily covered with commercial timber. There are a number of good reservoir sites on this stream and its tributaries.

Tuolumne River rises on the western slope of the Sierra Nevada in California and drains the country between Stanislaus River on the north and Merced River on the south. The northern half of Yosemite National Park includes a portion of the drainage basin of this stream. The river is fed largely from small mountain lakes occurring high in the drainage basin, where the snow remains on the mountain slopes throughout the year, thus insuring a large run-off. The stream has a heavy fall, and the opportunities for power development are numerous. There are also a number of reservoir sites in the basin where flood water could be stored for use during the irrigation season. The Tuolumne is an important tributary of the San Joaquin.

Merced River above Merced Falls drains approximately 1,090 square miles of the western slopes of the Sierra Nevada. There are included in the eastern portion of its drainage area a large number of high peaks, the highest, Mount Lyell, reaching an elevation of 13,042 feet. Its basin lies south of that of the Tuolumne, the courses of the two streams being nearly parallel.

King River rises on the western slope of the Sierra Nevada, in Fresno County, Cal. The waters coming from the high catchment basin are probably of greater value for irrigation purposes than those of any other stream in central California, being used for raising grapes and deciduous fruits in the neighborhood of Fresno, Selma, and Hanford. The summer flow of the river is now entirely diverted, and during the dry season of the last few years the scarcity of water has caused many hardships. In the spring there is a large surplus, due to the melting of snows, which, if stored in suitable reservoirs, would bring larger areas under cultivation. The river has a relatively gentle grade, affording little opportunity for power development.

Tule River drains a portion of the western slope of the Sierra Nevada. Its basin has somewhat less run-off than that of Kaweah River, which joins it on the north, and is much less elevated and snow-covered than King River basin. The water of this stream is all appropriated during the irrigation season, and a portion is used in irrigating valuable orange lands in the vicinity of Portersville, Cal.

Kern River flows from the southern end of the Sierra Nevada, being formed by two large tributaries, known as North and South forks.

These have a general southerly and parallel course and unite a short distance below the town of Kernville. The run-off from the drainage basin as a whole is notably less than that from the catchment areas to the north. This is probably due to the fact that a portion of the basin is to the east of the high crest, and is sheltered by the mountain mass from the rain-bearing winds. The waters of Kern River are almost completely used for irrigation by the large canals in the southern end of the San Joaquin Valley. The greater part of the land is included in large holdings owned by the Kern County Land Company or by the Miller and Lux estate. The winter waters are in part stored by the Miller and Lux estate in Buena Vista Lake, into which the river naturally discharges. The waters of this lake are controlled by a system of levees, so that they can be used during the following summer to irrigate lands lying to the northwest. This lake is very broad and shallow, and there is great loss by evaporation, so that as a matter of economy it would be desirable to hold this water in the upper mountain valleys. This would afford also a large supply for water power.

The fall of Kern River is sufficiently large for the development of a considerable amount of water power.

The following pages give the results of data collected in the San Francisco Bay drainage basin during 1904:

PUTA CREEK NEAR GUENOC, CAL.

This station was established on February 12, 1904. It is located about 1 mile below the town of Guenoc and at the Guenoc dam site. The gage is made of 2 by 6 inch plank, and is graduated to feet and tenths. There are two sections of the gage, both being fastened to trees. These gages are about 500 feet upstream from the station, and are read once a day at ordinary stages of the creek and twice each day, in times of high water, by Mrs. Irene Asbill, the observer. Discharge measurements are made from a car and cable. An auxiliary cable has been placed 150 feet downstream parallel to the large one, so that float measurements can be easily made in times of very high water. The initial point for soundings is the eyebolt to which the cable is fastened on the left bank. The channel is straight for 250 feet above and below the station. At ordinary and low-water stages the velocity is moderate. The left bank is high and is not subject to overflow. For gage readings above 20 feet the water spreads over a bench on the right side, but does not overflow the bank. The bed of the stream is composed of gravel and is not subject to any material change. The bench mark is a spike driven in the root of the tree to which the upper section of the gage is fastened, and its elevation is 16.44 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Puta Creek near Guenoc, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 12	S. G. Bennett	12.0	12,721
February 12	do	13.7	14,536
July 12	W. B. Clapp	3.62	14.7
August 22	do	3.50	9.5
November 15	O. W. Peterson	4.27	107

Mean daily gage height, in feet, of Puta Creek near Guenoc, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	5.70	5.65	4.60	3.90	3.70	(3.60)	(3.50)	3.60	3.70	3.90
2	.....	.....	5.55	5.45	4.50	(3.90)	3.70	3.60	3.50	3.60	3.70	4.00
3	.....	.....	5.35	5.35	4.50	3.90	3.70	3.60	3.50	3.60	3.80	4.00
4	.....	.....	5.15	5.20	4.50	3.90	(3.70)	(3.60)	3.50	3.60	3.80	4.10
5	.....	.....	5.10	5.10	4.40	3.90	3.70	3.60	3.50	3.50	3.80	4.10
6	.....	.....	5.05	5.00	4.40	(3.90)	3.70	(3.60)	3.50	3.50	3.90	4.10
7	.....	.....	5.15	4.90	4.30	(3.90)	(3.70)	3.60	3.50	3.50	3.90	4.00
8	.....	.....	5.45	4.80	4.30	3.90	3.70	(3.60)	3.50	3.70	3.80	4.00
9	.....	.....	5.35	4.80	4.30	3.80	3.70	3.50	(3.50)	4.70	3.80	3.90
10	.....	.....	16.65	4.70	4.20	3.80	3.60	(3.50)	3.50	5.40	3.80	3.90
11	.....	.....	8.00	4.70	4.20	(3.80)	3.60	(3.50)	3.50	5.00	3.80	3.90
12	.....	9.20	6.45	4.60	4.20	3.80	(3.60)	3.50	(3.50)	4.50	3.80	3.90
13	.....	6.50	5.85	4.60	4.20	(3.80)	3.60	3.50	3.50	4.30	3.80	4.00
14	.....	5.80	7.20	4.70	4.20	3.80	3.60	(3.50)	3.50	4.20	3.80	4.00
15	.....	14.40	6.20	4.70	4.10	3.70	(3.60)	(3.50)	3.50	4.20	4.20	4.00
16	.....	9.10	5.65	4.60	4.10	3.70	3.60	(3.50)	3.50	4.20	4.10	3.90
17	.....	6.60	9.70	4.60	4.10	3.70	3.60	(3.50)	3.50	4.20	4.00	3.90
18	.....	5.85	7.85	(5.10)	4.10	(3.70)	3.60	(3.50)	3.50	4.20	4.00	3.90
19	.....	5.50	8.75	5.60	4.00	3.70	3.60	(3.50)	3.50	4.10	4.00	4.00
20	.....	5.25	6.90	5.10	4.00	3.70	3.60	(3.50)	3.50	4.10	3.90	4.00
21	.....	5.30	6.20	4.80	4.00	3.70	3.50	(3.50)	3.50	4.10	3.90	4.00
22	.....	6.95	6.00	4.80	4.00	3.70	3.60	3.50	3.50	4.00	3.90	4.10
23	.....	5.75	6.35	4.70	4.00	(3.70)	3.60	3.50	3.50	4.00	3.90	4.10
24	.....	13.35	6.05	4.60	4.00	(3.70)	3.60	(3.30)	3.80	3.90	3.80	4.10
25	.....	6.85	5.80	4.60	4.00	3.70	(3.60)	3.50	3.90	3.90	3.80	4.10
26	.....	9.25	5.95	4.70	(4.00)	3.70	(3.60)	3.50	3.80	3.80	3.80	4.20
27	.....	7.45	6.80	4.70	(4.00)	(3.70)	3.60	3.50	3.60	3.80	3.80	4.20
28	.....	6.25	9.10	4.80	4.00	(3.70)	3.60	3.50	3.60	3.80	3.80	4.20
29	.....	6.00	7.25	4.70	4.00	3.70	3.60	(3.50)	(3.60)	3.80	3.80	4.20
30	.....	.....	6.25	4.60	4.00	3.70	3.60	3.50	3.60	3.80	3.90	12.75
31	.....	.....	5.85	.....	4.00	.....	3.60	3.50	.....	3.70	.....	11.25

NOTE.—Gage heights in parenthesis are estimated.

Rating table for Puta Creek near Guenoc, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.50	9.5	5.00	310	6.50	1,200	9.00	5,000
3.60	14	5.10	350	6.60	1,300	9.20	5,400
3.70	22	5.20	400	6.70	1,400	9.40	5,800
3.80	34	5.30	450	6.80	1,500	9.60	6,230
3.90	47	5.40	500	6.90	1,600	9.80	6,690
4.00	60	5.50	550	7.00	1,700	10.00	7,150
4.10	75	5.60	600	7.20	1,950	10.50	8,300
4.20	90	5.70	660	7.40	2,200	11.00	9,450
4.30	110	5.80	720	7.60	2,490	11.50	10,600
4.40	130	5.90	780	7.80	2,800	12.00	11,800
4.50	155	6.00	840	8.00	3,120	13.00	14,200
4.60	180	6.10	900	8.20	3,440	14.00	16,700
4.70	205	6.20	960	8.40	3,800		
4.80	240	6.30	1,040	8.60	4,200		
4.90	275	6.40	1,120	8.80	4,600		

Estimated monthly discharge of Puta Creek near Guenoc, Cal., for 1904.

[Drainage area, 91 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	60	60	[a] 60	3,689	0.66	0.76
February	17,700	60	2,515	144,664	27.64	29.81
March	23,325	330	2,168	133,305	23.18	27.46
April	630	180	279	16,602	3.07	3.43
May	180	60	89	5,472	.98	1.13
June	47	22	31	1,845	.34	.38
July	22	14	16	984	.18	.21
August	14	9.5	11	676	.12	.14
September	47	9.5	13	774	.14	.16
October	500	9.5	80	4,919	.88	1.01
November	90	22	42	2,499	.46	.51
December	13,600	47	821	50,481	9.02	10.40
The year	23,325	9.5	510	365,910	5.61	75.40

[a] Estimated.

Evaporation record of Clear Lake at Lakeport, Cal., 1901–1904.

[D. C. Rumsey, observer.]

Month.	1901.		1902.		1903.		1904.	
	Evaporation in inches.		Evaporation in inches.		Evaporation in inches.		Evaporation in inches.	
	Lake.	Land.	Lake.	Land.	Lake.	Land.	Lake.	Land.
January	0.85	.....	0.85	0.85	0.50	0.60	0.95	0.85
February	.95	.....	.25	.30	.80	.75	.35	.35
March	2.40	.....	1.60	1.55	.65	.65	.50	.50
April	3.05	.....	2.60	2.35	2.18	2.36	1.95	2.10
May	3.70	.....	4.00	3.70	5.12	5.74	4.60	5.05
June	3.95	.....	4.65	5.15	5.25	7.56	7.00	7.40
July	5.15	.....	6.65	7.40	6.33	8.37	7.45	8.60
August	5.00	.....	4.40	4.95	7.00	7.77	7.15	7.85
September	3.35	[a] 1.6	4.10	4.40	5.12	5.09	4.85	5.05
October	2.30	2.45	1.95	1.85	2.65	2.45	2.05	2.30
November	.85	1.05	.45	.45	1.07	1.05	1.25	1.35
December	1.30	.95	.40	.45	.92	.79	.75	.75
Annual	32.85	6.05	31.90	33.40	37.59	43.18	38.85	42.15

[a] September 15 to 29.

CACHE CREEK AT LOWER LAKE, CAL.

This station was established January 1, 1900, by S. G. Bennett. The original gage was located at the wagon bridge, from which discharge measurements were made. On March 26, 1903, a cable was installed 300 feet above the bridge, and a new gage was established 100 feet above the cable. The present gage is a vertical 1 by 3 inch plank nailed to a 6 by 6 inch timber driven into the bed of the river and fastened to a large willow tree on the left bank. On March 26, when the new gage was put in place, the reading was 5.7 feet. The old gage read 4.4 feet on the same date. The gage is read once each day by Mrs. J. R. Anderson. The initial point for soundings is a small tree in line with the cable on the left bank, 28 feet from the tree to which the cable is attached. The channel is straight for 150 feet above and for 300 feet below the station. The current has a moderate velocity at ordinary stages. The right bank is low and will overflow at a gage height of about 10 feet. It is covered with a thick growth of willow and oak trees for 100 feet back from the water's edge. The left bank is high and rocky and is not liable to overflow. The bed of the stream is composed of firm gravel and changes only slightly. Gravel is sometimes washed in from Siegler Creek, 300 feet below the cable. The bench mark is a nail in the root of the oak tree to which cable is fastened on the left bank. Its elevation is 8.32 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Cache Creek at Lower Lake, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 2	J. R. Anderson	3.50	194
January 9	do	3.60	206
January 16	do	3.60	210
January 23	do	3.70	238
January 31	do	3.70	239
February 6	do	3.80	250
February 12	do	4.48	277
February 13	do	4.30	363
February 21	do	5.30	633
February 24	do	7.58	281
February 27	do	7.40	1,108
March 5	do	7.90	1,286
March 12	do	10.50	2,412
March 19	do	11.40	2,759
March 23	do	11.60	3,275
March 26	do	11.50	3,009
March 28	do	12.00	2,700
April 17	do	10.50	2,631
April 24	do	10.00	2,363
May 2	do	9.50	2,008
May 7	do	8.80	1,774
May 14	do	8.20	1,550
May 20	do	7.20	1,238
May 28	do	6.55	1,026
June 4	do	6.15	924
June 11	do	5.80	842
June 18	do	5.60	780
June 27	do	5.30	678
July 4	do	5.10	598
July 9	do	4.85	500
July 16	do	4.70	473
July 23	do	4.50	419
July 30	do	4.35	407
August 6	do	4.20	359
August 13	do	4.10	325
August 21	W. B. Clapp	3.90	287
August 20	J. R. Anderson	3.90	282
August 27	do	3.80	260
September 3	do	3.60	231

Discharge measurements of Cache Creek at Lower Lake, Cal., in 1904—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 10	J. R. Anderson	3.55	201
September 17	do	3.45	180
September 24	do	3.35	160
October 1	do	3.40	166
October 8	do	3.30	149
October 15	do	3.50	191
October 23	do	3.40	168
October 30	do	3.40	164
November 5	do	3.30	145
November 13	do	3.25	137
November 20	do	3.30	142
November 26	do	3.20	128
December 4	do	3.25	129
December 11	do	3.25	122
December 17	do	3.30	130

Mean daily gage height, in feet, of Cache Creek at Lower Lake, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.50	3.70	7.80	12.10	9.50	6.30	5.15	4.30	3.70	3.40	3.30	3.30
2	3.50	3.70	7.90	12.10	9.40	6.25	5.15	4.25	3.65	3.40	3.30	3.30
3	3.50	3.70	7.95	12.00	9.30	6.30	5.10	4.25	3.65	3.40	3.30	3.30
4	3.60	3.80	7.95	11.90	9.20	6.15	5.10	4.20	3.60	3.35	3.30	3.25
5	3.55	3.75	a7.90	11.85	9.15	6.10	5.05	4.20	3.60	3.35	3.30	3.25
6	3.55	3.80	8.05	11.70	9.00	6.20	5.05	4.20	3.60	3.40	3.30	3.25
7	3.55	3.80	8.10	11.60	8.80	6.10	5.00	4.20	3.60	3.30	3.35	3.25
8	3.55	3.85	8.45	11.45	8.75	6.00	5.00	4.15	3.60	3.30	3.35	3.25
9	3.60	3.80	8.20	11.40	8.65	6.00	4.90	4.15	3.55	3.35	3.35	3.25
10	3.55	3.80	10.15	11.25	8.55	5.90	4.85	4.10	3.55	3.35	3.30	3.25
11	3.60	3.80	10.25	11.20	8.50	5.80	4.85	4.10	3.55	3.55	3.30	3.25
12	3.55	a4.55	a10.50	11.10	8.40	5.80	4.80	4.10	3.50	3.50	3.25	3.25
13	3.55	4.30	10.60	10.95	8.30	5.70	4.80	4.10	3.50	3.45	3.25	3.25
14	3.60	4.40	10.75	10.80	8.20	5.70	4.80	4.05	3.50	3.40	3.35	3.30
15	3.60	5.10	10.80	10.75	8.10	5.70	4.75	4.05	3.50	3.50	3.30	3.30
16	3.60	5.00	10.75	10.60	7.90	5.65	4.70	4.00	3.45	3.50	3.25	3.30
17	3.70	5.00	11.00	10.50	7.70	5.60	4.65	4.00	3.45	3.45	3.25	3.30
18	3.65	5.05	11.20	10.35	7.70	5.55	4.65	4.00	3.40	3.45	3.25	3.30
19	3.70	5.10	a11.40	10.50	7.40	5.50	4.60	3.90	3.40	3.45	3.25	3.30
20	3.70	5.20	11.65	10.45	7.25	5.50	4.60	3.90	3.40	3.40	3.25	3.30
21	3.70	5.30	11.55	10.25	7.10	5.50	4.55	3.90	3.40	3.40	3.25	3.30
22	3.70	5.45	11.60	10.30	7.00	5.50	4.55	3.90	3.40	3.40	3.25	3.30
23	3.70	5.60	11.60	10.10	6.90	5.40	4.50	3.85	3.40	3.40	3.25	3.30
24	3.70	a7.10	11.80	10.00	6.90	5.35	4.50	3.85	3.35	3.40	3.25	3.40
25	3.70	6.45	11.65	9.85	6.80	5.35	4.50	3.80	3.45	3.35	3.20	3.30
26	3.70	a7.40	a11.50	9.85	6.70	5.30	4.50	3.80	3.45	3.35	3.20	3.30
27	3.70	7.40	11.60	9.70	6.65	5.30	4.45	3.80	3.45	3.35	3.30	3.30
28	3.70	7.60	a12.80	9.70	6.55	5.25	4.45	3.80	3.45	3.35	3.30	3.25
29	3.70	7.70	12.00	9.60	6.50	5.20	4.40	3.75	3.40	3.35	3.30	3.30
30	3.70	.....	12.00	9.55	6.50	5.20	4.35	3.75	3.40	3.40	3.35	3.30
31	3.70	.....	12.00	.....	6.40	.....	4.30	3.70	.....	3.35	.....	4.10

a Gage height increased by backwater. Rating table not used. Discharge for day determined by meter measurement.

Rating table for Cache Creek at Lower Lake, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.20	126	4.70	475	6.20	910	8.40	1,640
3.30	147	4.80	500	6.30	940	8.60	1,710
3.40	168	4.90	525	6.40	970	8.80	1,780
3.50	189	5.00	550	6.50	1,000	9.00	1,850
3.60	210	5.10	580	6.60	1,030	9.20	1,930
3.70	231	5.20	610	6.70	1,060	9.40	2,010
3.80	253	5.30	640	6.80	1,090	9.60	2,100
3.90	276	5.40	670	6.90	1,120	9.80	2,200
4.00	300	5.50	700	7.00	1,150	10.00	2,300
4.10	325	5.60	730	7.20	1,220	10.50	2,600
4.20	350	5.70	760	7.40	1,290	11.00	2,900
4.30	375	5.80	790	7.60	1,360	11.50	3,250
4.40	400	5.90	820	7.80	1,430	12.00	3,600
4.50	425	6.00	850	8.00	1,500		
4.60	450	6.10	880	8.20	1,570		

Estimated monthly discharge of Cache Creek at Lower Lake, Cal., for 1904.

[Drainage area, 500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1904.						
January	231	189	216	13,281	0.43	0.50
February	1,395	231	541	31,119	1.08	1.16
March	3,600	1,286	2,588	159,130	5.18	5.97
April	3,680	2,075	2,801	166,671	5.60	6.25
May	2,050	970	1,460	89,772	2.92	3.37
June	940	610	762	45,342	1.52	1.70
July	595	375	483	29,699	.97	1.12
August	375	231	302	18,569	.60	.69
September	231	158	188	11,187	.38	.42
October	200	147	168	10,330	.34	.39
November	158	126	143	8,509	.29	.32
December	640	136	165	10,145	.33	.38
The year	3,680	126	818	593,754	1.64	22.27

CACHE CREEK NEAR YOLO, CAL.

This station was established January 1, 1903, by S. G. Bennett. It is located at the wagon bridge on the road from Woodland to Yolo, about 1,000 feet above the Southern Pacific Railway bridge. The gage is a 2 by 12 inch vertical plank nailed to the upstream side of the right abutment. It is read twice each day by John Woodard. Discharge measurements are made from the downstream side of the bridge, to which the gage is attached. The initial point for soundings is the end of the bridge on the right bank. The channel is straight for 1,000 feet above and below the station. The current is swift at ordinary and high stages. The banks are steep and wooded and their height has been increased by levees. They are said to overflow at extreme high water. The bed of the stream is composed of earth and gravel, with a little sand, and is not subject to any material change. On December 4, 1904, this station was reestablished by O. W. Peterson. A new bridge which has been erected greatly improves the conditions. The gage is in four sections, three of which are above the bridge and the fourth is bolted to the face of the concrete abutment on the right bank. The gages are made of 3 by 8-inch timber, painted white and graduated to feet and tenths. The gage datum remains the same as before.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Cache Creek near Yolo, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 28	W. B. Newhall	2.40	283
February 10	F. W. Huber	2.50	371
February 16	do	14.25	8,770
February 17	do	9.65	4,782
February 17	do	8.25	4,124
February 18	do	6.35	3,514
February 19	do	5.55	2,772
March 11	S. G. Bennett	17.80	8,300
March 12	do	12.10	5,195
April 9	W. B. Newhall	8.20	3,714
June 17	O. W. Peterson	3.75	724
July 13	do	2.90	435
August 10	do	2.30	210
October 4	do	1.80	111
December 4	do	2.05	148
December 10	do	2.05	150

Mean daily gage height, in feet, of Cache Creek near Yolo, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.10	2.30	7.85	9.70	6.50	4.30	3.00	2.20	1.50	(1.80)	2.00	2.15
2	2.10	2.35	7.30	9.45	6.40	4.20	3.00	2.20	1.50	1.80	2.00	2.10
3	2.10	2.45	7.05	9.15	6.35	4.15	3.00	2.10	1.50	1.80	2.00	2.10
4	2.10	2.50	6.85	8.90	6.30	4.10	2.95	2.10	1.50	1.80	1.90	2.05
5	2.10	2.60	6.65	8.65	6.20	4.00	2.90	2.10	1.50	1.80	1.90	2.05
6	2.10	2.60	6.45	8.45	6.15	3.95	2.90	2.00	1.50	1.80	1.90	2.05
7	2.10	2.60	6.35	8.30	6.05	3.90	2.90	2.00	1.50	1.70	1.90	2.05
8	2.10	2.55	6.30	8.20	6.00	3.80	2.90	2.00	1.50	1.70	1.90	2.05
9	2.10	2.50	6.20	8.10	5.85	3.75	2.80	2.00	1.50	1.70	1.90	2.05
10	2.10	2.50	14.75	8.00	5.80	3.70	2.80	1.90	1.50	3.00	1.90	2.05
11	2.10	2.50	20.75	7.90	5.70	3.60	2.80	1.90	[a](1.50)	5.05	1.80	2.05
12	2.10	5.95	12.00	7.80	5.65	3.55	2.80	1.90	(1.50)	4.10	1.80	2.15
13	2.10	9.25	10.75	7.70	5.60	3.50	2.70	1.90	(1.50)	3.45	1.80	2.15
14	2.10	5.50	10.60	7.60	5.50	3.50	2.70	1.80	(1.50)	3.00	1.80	2.15
15	2.10	5.25	10.50	7.50	5.40	3.50	2.65	1.80	(1.50)	2.65	1.80	2.10
16	2.10	16.75	10.40	7.40	5.35	3.40	2.60	1.80	(1.50)	2.45	1.70	2.10
17	2.10	8.75	11.65	7.40	5.30	3.40	2.60	1.70	(1.50)	2.30	1.70	2.10
18	2.10	7.00	16.50	7.30	5.20	3.40	2.60	1.70	(1.50)	2.30	1.70	2.10
19	2.50	5.80	11.75	7.20	5.15	3.40	2.55	1.70	(1.50)	2.20	1.70	2.10
20	2.40	5.10	10.55	7.10	5.10	3.30	2.50	1.70	(1.50)	2.20	1.70	2.10
21	2.40	4.90	10.25	7.00	5.00	3.30	2.50	1.70	(1.50)	2.20	1.70	2.10
22	2.40	11.00	10.10	6.90	4.95	3.30	2.40	1.70	(1.60)	2.10	1.70	2.10
23	2.40	14.75	11.00	6.85	4.90	3.20	2.40	1.70	(1.70)	2.10	1.70	2.15
24	2.30	16.50	9.80	6.80	4.80	3.20	2.40	1.70	(1.70)	2.10	1.90	2.15
25	2.30	7.50	9.80	6.80	4.75	3.20	2.40	1.70	(1.90)	2.10	1.90	2.15
26	2.30	13.00	9.65	6.70	4.70	3.20	2.35	1.70	(1.90)	2.10	1.90	2.10
27	2.30	16.50	9.50	6.70	4.60	3.10	2.30	1.70	(1.90)	2.10	1.90	2.10
28	2.30	9.60	16.75	6.60	4.55	3.10	2.30	1.70	(1.80)	2.00	1.90	2.10
29	2.30	8.60	14.50	6.60	4.50	3.10	2.30	1.60	(1.80)	2.00	2.20	2.05
30	2.20	.....	11.70	6.50	4.40	3.10	2.30	1.60	(1.80)	2.00	2.20	2.30
31	2.20	.....	10.40	.....	4.35	.....	2.20	1.60	.....	2.00	.....	15.20

[a] Gage destroyed. From September 11 to October 1 gage heights determined by comparison with those on Stony Creek.

Rating table for Cache Creek near Yolo, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	22	2.60	305	4.20	980	6.60	2,420
1.10	30	2.70	340	4.30	1,030	6.80	2,560
1.20	40	2.80	375	4.40	1,080	7.00	2,700
1.30	50	2.90	410	4.50	1,130	7.20	2,850
1.40	60	3.00	445	4.60	1,185	7.40	3,000
1.50	70	3.10	495	4.70	1,240	7.60	3,150
1.60	82	3.20	535	4.80	1,295	7.80	3,300
1.70	96	3.30	575	4.90	1,350	8.00	3,450
1.80	110	3.40	615	5.00	1,405	8.50	3,825
1.90	125	3.50	655	5.20	1,525	9.00	4,200
2.00	140	3.60	700	5.40	1,645	9.50	4,600
2.10	160	3.70	745	5.60	1,770	10.00	5,000
2.20	180	3.80	790	5.80	1,900	11.00	5,900
2.30	205	3.90	835	6.00	2,030	12.00	6,800
2.40	235	4.00	880	6.20	2,160	14.00	8,600
2.50	270	4.10	930	6.40	2,290	16.00	10,500

Estimated monthly discharge of Cache Creek near Yolo, Cal., for 1904.

[Drainage area, 1,280 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	270	160	183	11,252	0.14	0.16
February	11,250	205	3,166	182,110	2.47	2.66
March	15,250	2,160	5,591	343,777	4.37	5.04
April	4,760	2,355	3,188	189,699	2.49	2.78
May	2,355	1,055	1,656	101,824	1.29	1.49
June	1,030	495	681	40,522	.53	.59
July	445	180	316	19,430	.25	.29
August	180	82	117	7,194	.09	.10
September	125	70	82	4,879	.06	.07
October	1,435	96	254	15,618	.20	.23
November	180	96	120	7,140	.09	.10
December	9,700	150	469	28,838	.37	.43
The year	15,250	70	1,319	952,283	1.03	13.94

STONY CREEK NEAR FRUTO, CAL.

This station was established on January 30, 1901, by Burt Cole. It is located at Julian's ranch, 6 miles northwest of Fruto, and 1¾ miles above the proposed Mill Site dam. The gage is in two sections. The low-water gage, which is bolted to the rock, is a 2 by 8 inch plank and is graduated to feet and tenths. The high-water gage is a 6 by 6 inch timber painted white and graduated to feet and tenths. The gage is read twice each day by W. H. Julian. Discharge measurements are made from a car and cable. The initial point for soundings is the eye-bolt on the left bank to which the cable is attached. The channel is straight for 200 feet above and 200 feet below the cable. The current is very swift at high water and sluggish at low water. Neither bank is subject to overflow, but at high stages of the creek the water spreads to the right for several hundred feet. The bed of the stream is of gravel and is subject to some change. The bench mark is the head of an iron bolt set in the rock near the upper gage at an elevation of 14.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Stony Creek near Fruto, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 27	W. B. Newhall	4.25	321
February 10	F. W. Huber	4.2	293
February 18	W. B. Newhall	7.25	2,507
February 25	F. W. Huber	10.15	7,001
February 26	do	8.85	5,387
February 26	do	11.35	12,447
April 8	A. C. Lootz	6.6	2,050
April 8	do	6.6	2,009
April 9	do	6.6	1,943
April 10	do	6.5	1,986
April 11	do	6.5	2,069
June 15	O. W. Peterson	4.2	202
July 13	do	3.63	63
August 9	do	3.5	16
October 3	do	3.5	44

Mean daily gage height, in feet, of Stony Creek near Fruto, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.20	4.10	7.20	7.35	5.50	4.50	3.50	3.30	3.20	3.40	3.50	3.90
2	4.20	4.10	7.20	7.25	5.50	4.50	3.50	3.30	3.20	3.40	3.50	3.90
3	4.20	4.10	7.10	7.00	5.50	4.50	3.50	3.30	3.20	3.50	3.50	3.90
4	4.20	4.10	7.05	6.80	5.50	4.40	3.50	3.30	3.20	3.50	3.50	3.90
5	4.20	4.60	6.75	6.70	5.40	4.40	3.50	3.30	3.20	3.50	3.50	3.90
6	4.20	4.35	6.85	6.60	5.40	4.40	3.50	3.30	3.20	3.50	3.50	3.90
7	4.20	4.30	7.55	6.50	5.40	4.30	3.50	3.30	3.20	3.50	3.50	3.90
8	4.20	4.30	7.65	6.60	5.30	4.30	3.50	3.30	3.20	3.50	3.50	3.90
9	4.20	4.30	7.25	6.60	5.30	4.30	3.50	3.30	3.20	3.60	3.50	4.10
10	4.20	4.20	13.25	6.60	5.30	4.20	3.50	3.30	3.20	3.60	3.50	4.20
11	4.40	4.20	9.25	6.60	5.30	4.20	3.50	3.30	3.20	6.55	3.50	4.30
12	4.30	9.00	7.85	6.50	5.30	4.10	3.50	3.30	3.20	5.50	3.50	4.30
13	4.20	6.25	7.35	6.40	5.30	4.10	3.50	3.30	3.20	5.00	3.50	4.50
14	4.20	5.45	8.65	6.30	5.20	4.00	3.50	3.30	3.20	4.00	3.50	4.50
15	4.20	8.25	8.00	6.20	5.20	4.00	3.50	3.30	3.20	3.80	3.60	4.30
16	4.20	12.25	7.60	6.00	5.20	3.90	3.50	3.30	3.20	3.80	3.60	4.20
17	4.40	8.25	10.50	5.90	5.10	3.90	3.40	3.30	3.20	3.70	3.70	4.10
18	4.40	7.20	9.75	5.80	5.10	3.90	3.40	3.30	3.20	3.70	3.70	4.00
19	4.40	6.65	8.85	6.10	5.10	3.80	3.40	3.30	3.20	3.70	3.70	4.00
20	4.40	5.85	8.90	5.80	5.00	3.80	3.40	3.30	3.20	3.60	3.70	4.00
21	4.30	7.85	8.00	5.70	5.00	3.80	3.40	3.20	3.20	3.60	3.70	3.90
22	4.30	11.75	7.45	5.70	4.90	3.70	3.40	3.20	3.30	3.60	3.70	3.90
23	4.30	8.85	7.20	5.60	4.90	3.70	3.40	3.20	3.40	3.60	3.70	3.90
24	4.30	13.50	6.95	5.50	4.90	3.60	3.30	3.20	3.40	3.50	3.70	4.30
25	4.30	10.00	6.80	5.50	4.80	3.60	3.30	3.20	3.60	3.50	3.70	4.20
26	4.30	10.00	6.65	5.50	4.80	3.50	3.30	3.20	3.60	3.50	3.70	4.20
27	4.20	9.05	8.35	5.60	4.80	3.50	3.30	3.20	3.60	3.50	4.10	4.20
28	4.20	7.90	10.50	5.60	4.80	3.50	3.30	3.20	3.50	3.50	4.00	4.10
29	4.20	7.40	9.35	5.60	4.70	3.50	3.30	3.20	3.50	3.50	3.90	4.10
30	4.20	.....	8.55	5.60	4.70	3.50	3.30	3.20	3.40	3.50	3.90	9.35
31	4.20	.....	7.30	.....	4.60	.....	3.30	3.20	.....	3.50	.....	7.40

Rating table for Stony Creek near Fruto, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.20	9	4.80	500	6.30	1,680	8.60	4,600
3.30	16	4.90	560	6.40	1,780	8.80	4,930
3.40	30	5.00	620	6.50	1,880	9.00	5,270
3.50	45	5.10	685	6.60	1,980	9.20	5,630
3.60	60	5.20	755	6.70	2,090	9.40	6,000
3.70	80	5.30	830	6.80	2,200	9.60	6,400
3.80	100	5.40	905	6.90	2,310	9.80	6,800
3.90	120	5.50	980	7.00	2,420	10.00	7,280
4.00	150	5.60	1,060	7.20	2,660	10.50	8,560
4.10	180	5.70	1,140	7.40	2,900	11.00	10,200
4.20	210	5.80	1,220	7.60	3,150	11.50	12,200
4.30	250	5.90	1,310	7.80	3,410	12.00	14,200
4.40	300	6.00	1,400	8.00	3,690	12.50	16,700
4.50	350	6.10	1,490	8.20	3,980	13.00	19,200
4.60	400	6.20	1,580	8.40	4,280	13.50	22,200
4.70	450						

Estimated monthly discharge of Stony Creek near Fruto, Cal., for 1904.

[Drainage area, 760 square miles.]

Month.	Discharge in second-feet			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	300	210	234	14,388	0.31	0.36
February	22,220	180	3,800	218,578	5.00	5.39
March	20,700	2,035	4,364	268,332	5.74	6.62
April	2,840	980	1,604	95,445	2.11	2.35
May	980	400	715	43,964	.94	1.08
June	350	45	165	9,818	.22	.25
July	45	16	34	2,091	.04	.05
August	16	9	14	861	.02	.02
September	60	9	19	1,131	.02	.02
October	1,930	30	167	10,268	.22	.25
November	180	45	71	4,225	.09	.10
December	5,905	120	453	27,854	.60	.69
The year	22,220	9	970	696,955	1.28	17.18

SACRAMENTO RIVER NEAR RED BLUFF, CAL.

The gaging station at Jellys Ferry, which is located about 12 miles above the town of Red Bluff, was established April 30, 1895. The right bank of the river is high, but the left bank is liable to overflow when the river rises above the 25-foot mark. The river has been known to reach the 35-foot mark. Because of the liability to overflow it was deemed advisable to select a new gaging station where the water at flood stage would be more confined. A point in Iron Canyon, where the river had been gaged by the State engineering department in 1879 and by commissioner of public works in 1893–94, was chosen as a new gaging station. The river stage rod used by commissioner of public works was still in place and has been used in making river height observations since January 28, 1902, the date upon which the observations were begun. A second set of gage rods were placed on the right bank 3,200 feet below the gaging station January 1, 1904, as no observer could be obtained to continue readings of the station gage. By synchronous readings of the lower gages and the station gage the actual gage readings for this lower gage have been converted into equivalent readings for the station gage. Frank Wilcox read the gage once each day. On September 28, 1904, it was necessary to move the lower gage rods to the left bank about 4,000 feet below the gaging station. The actual readings of this set of gage rods have also been converted into

equivalent readings for the station gage. The gage is read twice each day by Fred Weeks. All reported gage heights are those determined for the station gage. The river at this point in lower portion of Iron Canyon, 4 miles above Red Bluff, has a direct course for 2 or 3 miles. The width between banks at low water is about 500 feet. The depth of water at low stages averages 6 feet, with a maximum depth of 9 feet. The banks are steep and firm. The river flows in a bed of coarse gravel and cobbles, with here and there a small bowlder. The bed rock is lava. Discharge measurements are made from a cable 600 feet in span, which is anchored in a lava rock which forms the wall of the canyon.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Sacramento River near Red Bluff, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 23	W. B. Newhall	3.15	10,584
February 8	F. W. Huber	2.8	10,674
February 17	S. G. Bennett	15.2	72,400
February 29	A. C. Lootz	12.3	57,381
March 30	S. G. Bennett	15.08	66,657
April 1	A. C. Lootz	11.75	44,429
April 1	do	11.6	43,843
April 2	A. Buffinger	10.55	42,759
April 2	A. C. Lootz	10.7	42,329
April 4	do	10.98	46,231
April 4	do	10.94	44,665
April 5	do	10.2	39,509
April 6	do	10.18	39,671
April 6	do	9.8	39,053
June 13	O. W. Peterson	3.72	12,450
July 15	do	2.25	7,846
August 10	W. B. Clapp	1.7	6,055
September 27	O. W. Peterson	2.15	7,460
December 7	do	2.48	8,055

Mean daily gage height, in feet, of Sacramento River near Red Bluff, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.60	2.80	13.10	11.90	8.50	5.05	2.80	2.20	1.50	1.70	2.20	3.75
2	3.50	2.50	15.55	10.50	8.40	4.80	2.80	2.20	1.50	1.55	2.70	3.15
3	3.40	2.40	14.40	10.70	8.30	4.70	2.80	2.05	1.50	1.65	2.50	2.95
4	3.40	2.30	15.80	10.70	8.20	4.50	2.80	2.05	1.50	1.65	2.20	2.80
5	3.15	2.50	14.70	10.60	8.05	4.40	2.80	2.05	1.50	1.65	2.20	2.70
6	3.00	3.30	13.10	10.50	7.95	4.30	2.80	1.90	1.50	1.55	2.20	2.55
7	2.90	3.30	16.30	10.10	7.75	4.30	2.70	1.90	1.50	1.70	2.20	2.50
8	3.40	3.30	24.40	9.90	7.60	4.20	2.70	1.90	1.50	2.15	2.20	2.50
9	3.40	3.30	18.95	9.80	7.50	4.30	2.65	1.90	1.50	4.10	2.20	2.60
10	3.40	3.30	17.90	9.65	7.40	4.20	2.65	1.80	1.50	7.45	2.20	3.15
11	3.40	3.30	15.80	9.60	7.30	3.95	2.65	1.80	1.50	11.20	2.15	2.75
12	3.15	3.30	14.70	9.65	7.20	3.85	2.65	1.80	1.50	7.25	2.15	3.25
13	3.00	6.30	13.30	9.65	7.10	3.75	2.65	1.80	1.50	4.60	2.15	3.85
14	2.90	6.30	15.80	9.80	7.00	3.60	2.65	1.80	1.50	3.80	2.15	3.65
15	2.80	17.35	17.25	9.90	6.90	3.60	2.65	1.80	1.50	4.15	2.75	3.25
16	3.00	[a]28.00	18.30	9.80	6.80	3.60	2.65	1.80	1.50	3.55	3.40	3.15
17	3.40	15.20	(18.85)	9.90	6.65	3.60	2.50	1.65	1.50	3.35	2.80	2.90
18	5.25	11.20	19.40	10.60	6.55	3.50	2.50	1.65	1.50	2.95	3.15	2.90
19	5.25	9.55	18.30	10.95	6.30	3.40	2.50	1.65	1.50	2.75	3.00	3.00
20	4.30	9.90	19.40	10.40	6.10	3.40	2.40	1.65	1.50	2.60	3.00	3.10
21	3.95	12.50	16.20	10.40	6.20	3.40	2.40	1.65	1.50	2.50	2.90	3.20
22	3.70	20.30	13.50	9.35	6.30	3.15	2.40	1.65	1.50	2.45	2.75	(2.90)
23	3.50	16.60	12.40	8.80	6.45	3.00	2.40	1.65	3.40	2.35	2.60	2.55
24	3.40	19.15	11.50	8.30	6.30	2.90	2.40	1.65	4.30	2.20	2.50	5.70
25	3.15	19.15	10.40	8.20	6.20	2.80	2.40	1.50	3.30	2.20	2.50	5.65
26	3.15	16.80	8.80	8.30	6.10	2.80	2.30	1.50	2.30	2.20	2.50	3.80
27	3.15	17.80	11.50	10.40	6.00	2.80	2.30	1.50	2.05	2.15	3.70	3.35
28	3.15	12.85	14.70	10.70	5.90	2.80	2.30	1.50	1.90	2.10	3.35	3.20
29	3.15	13.40	18.20	10.30	5.70	2.80	2.30	1.50	1.80	2.10	2.90	3.35
30	3.15	.....	14.80	8.80	5.60	2.80	2.30	1.50	1.80	2.15	3.70	12.50
31	3.00	.....	13.00	.....	5.50	.....	2.20	1.50	.....	2.30	.....	13.70

[a] Gage height 9 a. m. Highest known gage height 31.00 same night.

NOTE.—Gage heights in parenthesis are estimated.

Rating table for Sacramento River near Red Bluff, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	4,450	3.50	11,700	6.00	21,100	12.50	52,600
1.10	4,690	3.60	12,040	6.20	21,940	13.00	55,600
1.20	4,930	3.70	12,380	6.40	22,780	13.50	58,600
1.30	5,170	3.80	12,720	6.60	23,620	14.00	61,700
1.40	5,410	3.90	13,060	6.80	24,460	14.50	64,900
1.50	5,650	4.00	13,400	7.00	25,300	15.00	68,200
1.60	5,920	4.10	13,760	7.20	26,180	15.50	71,600
1.70	6,190	4.20	14,120	7.40	27,060	16.00	75,100
1.80	6,460	4.30	14,480	7.60	27,940	16.50	78,600
1.90	6,730	4.40	14,840	7.80	28,820	17.00	82,200
2.00	7,000	4.50	15,200	8.00	29,700	17.50	85,900
2.10	7,300	4.60	15,580	8.20	30,620	18.00	89,700
2.20	7,600	4.70	15,960	8.40	31,540	19.00	97,600
2.30	7,900	4.80	16,340	8.60	32,460	20.00	105,900
2.40	8,200	4.90	16,720	8.80	33,380	21.00	114,600
2.50	8,500	5.00	17,100	9.00	34,300	22.00	123,700
2.60	8,810	5.10	17,500	9.20	35,260	23.00	133,200
2.70	9,120	5.20	17,900	9.40	36,220	24.00	143,100
2.80	9,430	5.30	18,300	9.60	37,180	25.00	153,400
2.90	9,740	5.40	18,700	9.80	38,140	26.00	163,800
3.00	10,050	5.50	19,100	10.00	39,100	27.00	174,200
3.10	10,380	5.60	19,500	10.50	41,600	28.00	184,600
3.20	10,710	5.70	19,900	11.00	44,200		
3.30	11,040	5.80	20,300	11.50	46,900		
3.40	11,370	5.90	20,700	12.00	49,700		

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1902 to 1904, inclusive. It is well defined between gage heights 1 and 15 feet, and fairly well defined between gage heights 15 and 25 feet. The table has been extended beyond these limits. Above gage height 25 feet the rating curve is a tangent, the difference being 1,040 per tenth.

NOTE.—This table is for the gage at the station.

Estimated monthly discharge of Sacramento River near Red Bluff, Cal., for 1904.

[Drainage area, 9,295 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	18,100	9,430	11,489	706,431	1.24	1.43
February	184,600	7,900	46,346	2,665,852	4.99	5.38
March	100,880	33,380	73,281	4,505,873	7.88	9.08
April	49,140	30,620	38,906	2,315,068	4.19	4.67
May	32,000	19,100	25,080	1,542,109	2.70	3.11
June	17,300	9,430	12,362	735,590	1.33	1.48
July	9,430	7,600	8,656	532,237	.93	1.07
August	7,600	5,650	6,348	390,323	.68	.78
September	14,480	5,650	6,530	388,562	.70	.78
October	45,280	5,785	10,990	675,749	1.18	1.36
November	12,380	7,450	8,932	531,491	.96	1.07
December	59,840	8,500	13,875	853,141	1.49	1.72
The year	184,600	5,650	21,900	15,842,426	2.36	31.93

M'CLOUD RIVER NEAR GREGORY, CAL.

This station was established March 23, 1902, at the request of the consulting engineer of the McCloud River Electric Company, with the understanding that they would maintain the station. The watershed of McCloud River includes the southern and eastern slopes of Mount Shasta and is heavily timbered. The river is fed by the numerous springs and its minimum flow is about 1,100 second-feet. The gage rod is a 2 by 3 inch timber nailed and wired to a tree on the right bank of the stream at Johns Camp, 14 miles east of Gregory. Measurements are made from a car suspended from a wire cable. The initial point of sounding is at the gage rod on the right bank of the stream. The channel is straight for 300 feet above and for 600 feet below the gaging station. The current is swift at all stages. The banks are high and wooded and not liable to overflow. The bed is composed of limestone on the sides, with some large river gravel and bowlders in the center of the channel. Sufficient meter measurements have not been taken to construct a rating curve.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of McCloud River near Gregory, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 25	W. B. Newhall	1.85	1,900
August 8	W. B. Clapp	1.90	1,653
October 30	O. W. Peterson	1.75	1,600

Mean daily gage height, in feet, of McCloud River near Gregory, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.10	1.80	5.90	4.30	3.80	3.15	2.20	1.90	1.75	1.75	1.90	1.95
2	2.00	1.80	7.10	4.00	3.95	2.95	2.20	1.90	1.75	1.75	1.90	1.90
3	1.90	1.70	6.00	4.80	3.80	2.90	2.20	1.90	1.75	1.75	1.90	1.90
4	1.90	1.90	5.90	4.85	3.80	2.90	2.20	1.90	1.75	1.75	1.90	1.90
5	1.90	1.90	5.10	4.35	3.80	2.85	2.20	1.90	1.75	1.75	1.85	1.90
6	1.90	1.90	4.75	4.30	3.70	2.80	2.20	1.90	1.75	1.75	1.80	1.90
7	1.85	1.85	8.00	4.25	3.80	2.80	2.15	1.90	1.70	1.90	1.80	1.95
8	1.80	1.80	14.50	4.35	3.80	2.80	2.15	1.90	1.70	1.90	1.80	1.95
9	1.80	1.80	9.00	4.30	3.70	2.75	2.15	1.90	1.70	2.65	1.80	2.00
10	1.80	1.80	9.15	4.75	3.70	2.70	2.15	1.90	1.70	2.80	1.75	2.10
11	1.90	1.90	5.75	4.90	3.80	2.70	2.15	1.90	1.70	6.45	1.75	2.00
12	1.90	2.90	5.00	5.10	3.90	2.65	2.10	1.90	1.70	5.85	1.75	2.00
13	1.80	2.80	4.80	5.10	4.05	2.60	2.10	1.90	1.70	5.30	1.75	2.00
14	1.85	2.65	5.00	4.85	4.10	2.60	2.10	1.85	1.70	4.90	1.75	2.00
15	1.90	7.50	5.50	5.35	4.15	2.55	2.10	1.85	1.70	4.30	1.85	2.00
16	2.15	14.20	5.90	5.50	4.10	2.50	2.05	1.85	1.75	3.85	1.85	2.00
17	2.30	7.50	6.00	5.15	3.95	2.50	2.05	1.85	1.70	3.30	2.50	1.95
18	2.40	4.35	6.10	4.70	3.80	2.50	2.05	1.85	1.70	3.10	2.50	1.95
19	2.25	3.75	6.30	5.10	3.60	2.50	2.05	1.80	1.70	2.00	2.10	1.90
20	2.30	3.10	6.65	5.45	3.60	2.45	2.05	1.80	1.70	2.00	2.00	1.90
21	2.20	3.25	6.80	4.95	3.55	2.40	2.00	1.80	1.70	1.95	2.00	1.90
22	2.00	6.75	6.90	4.75	3.65	2.40	2.00	1.80	1.80	1.90	2.00	1.85
23	1.90	6.80	5.70	4.45	3.70	2.30	2.00	1.80	2.15	1.90	1.95	1.90
24	1.90	5.95	4.10	4.10	3.70	2.30	2.00	1.80	2.05	1.90	1.95	2.40
25	1.80	5.50	3.50	4.00	3.60	2.25	2.00	1.80	1.90	1.90	1.90	2.15
26	1.80	4.75	3.50	4.10	3.50	2.25	1.95	1.80	1.80	1.90	1.90	2.00
27	1.75	6.10	3.50	4.50	3.50	2.20	1.90	1.80	1.80	1.85	2.00	2.00
28	1.80	5.90	4.05	4.10	3.45	2.20	1.90	1.80	1.75	1.80	2.00	1.95
29	1.80	5.80	5.95	4.05	3.40	2.20	1.90	1.75	1.75	1.80	1.95	2.05
30	1.80	.....	5.50	3.95	3.35	2.20	1.90	1.75	1.75	1.90	2.00	4.20
31	1.80	.....	4.45	.....	3.30	.....	1.90	1.75	.....	1.85	.....	3.90

WEST VALLEY CREEK NEAR LIKELY, CAL.

This station was established January 7, 1904, by H. E. Green and J. S. Evans. It is located 7 miles east of Likely, Cal., at the outlet of West Valley. The gage is a 2 by 6 inch vertical plank nailed to a juniper tree on the right bank of the creek. Discharge measurements are made from cable and car, or by wading at low-water stage. The initial point for soundings is a juniper stump on left bank, which is

used for tying post for the car. The channel is straight for 200 feet above and 100 feet below station. The banks are high and not subject to overflow. The bed of the stream is rocky and not subject to change. The current is swift. The bench mark is on a large bowlder 30 feet from the creek on left bank and is marked with paint. It is 10.00 feet above the zero of the gage. As no one could be obtained to read the station gage, a gage was placed 2 miles above the station. The observer is Jasper L. Fountain. It is not deemed practical to make an estimated monthly discharge for the stream for 1904.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of West Valley Creek near Likely, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 7	J. S. Evans	3.18	21
February 2	do	3.30	20
February 16	do	4.95	200
February 25	do	3.75	74
March 18	do	3.70	74
April 2	do	3.50	51
May 24	do	4.30	138
June 6	do	3.90	70
June 14	S. G. Bennett	3.50	36
September 2	J. Y. Toler	2.90	10.3
September 17	do	3.04	15.8
September 24	do	3.15	14.8
September 30	do	3.20	16
October 12	do	3.35	20
October 19	J. Y. Toler and W. B. Clapp	3.30	29
October 29	J. Y. Toler	3.25	26
November 5	do	3.25	15.3
November 17	do	3.30	16.7
November 29	do	3.29	29
December 14	do	3.30	31
December 31	do	3.35	30

Mean daily gage height, in feet, of West Valley Creek near Likely, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.20	4.20	3.70	5.25	4.10	2.70	3.00	3.00	3.10	3.20	3.30
2	.....	3.20	4.10	3.90	4.95	4.05	2.70	3.00	3.00	3.10	3.20	3.25
3	.....	3.20	3.70	3.90	4.55	4.00	2.70	3.00	2.50	3.10	3.20	3.25
4	.....	3.40	3.75	4.10	4.50	3.95	2.70	3.00	2.50	3.10	3.20	3.25
5	.....	3.20	3.85	4.00	4.40	3.90	2.70	3.10	2.50	3.10	3.20	3.25
6	.....	3.20	4.00	4.10	4.40	3.85	2.70	3.00	2.50	3.20	3.20	3.25
7	.....	3.20	4.95	4.40	4.50	3.80	2.90	3.00	2.50	3.20	3.20	3.25
8	.....	3.20	4.50	4.80	4.45	3.80	2.75	3.00	2.50	3.10	3.20	3.25
9	.....	3.20	4.65	5.40	4.40	3.70	2.70	3.00	2.50	3.20	3.20	3.30
10	.....	3.20	4.20	5.20	4.60	3.55	2.70	3.00	2.50	3.20	3.20	3.30
11	.....	3.20	4.20	4.80	4.80	3.50	2.70	3.00	2.50	3.35	3.20	3.30
12	.....	3.30	4.10	4.80	4.90	3.40	2.70	3.00	2.50	3.20	3.20	3.30
13	3.20	3.75	5.50	4.50	4.90	3.40	2.70	3.00	2.50	3.20	3.20	3.25
14	3.20	4.35	5.75	4.50	4.95	3.30	2.70	3.00	2.50	3.25	3.20	3.25
15	3.20	5.00	5.25	4.50	4.95	3.20	2.70	3.00	2.50	3.25	3.20	3.25
16	3.20	4.85	5.00	(4.40)	4.85	3.20	2.70	(3.00)	2.50	3.20	3.20	3.25
17	3.35	4.30	4.30	(4.30)	4.85	3.20	2.70	3.00	2.50	3.20	3.20	3.25
18	3.40	3.95	4.10	(4.10)	4.85	3.10	2.70	3.00	2.50	3.20	3.20	3.25
19	3.25	3.75	4.10	4.00	4.85	3.10	(2.70)	3.00	2.50	3.20	3.20	3.25
20	3.20	3.70	3.90	3.95	4.65	3.10	(2.60)	3.00	2.50	3.20	3.25	3.25
21	3.20	4.60	3.70	4.05	4.45	3.10	2.60	3.00	2.50	3.20	3.25	3.25
22	3.20	7.25	3.85	3.90	4.45	3.00	2.60	3.00	2.50	3.20	3.25	3.30
23	3.30	5.30	3.70	3.85	4.45	3.00	2.60	3.00	2.60	3.20	3.25	3.25
24	3.20	7.20	3.85	3.85	4.45	3.00	2.60	3.00	2.60	3.20	3.25	3.20
25	3.20	5.25	3.85	3.80	4.35	3.00	2.60	3.00	3.20	3.20	3.25	3.20
26	3.20	5.00	4.20	3.80	4.30	3.00	2.60	(3.00)	3.30	3.20	3.25	3.20
27	3.20	4.65	5.00	3.85	4.15	2.80	2.60	3.00	3.20	3.20	3.25	3.20
28	3.20	4.20	7.10	4.25	4.05	2.80	2.60	3.00	3.20	3.20	3.25	3.20
29	3.30	4.00	6.85	5.25	3.95	2.70	2.60	3.00	(3.20)	3.20	3.25	3.20
30	3.40	.....	6.00	5.95	3.95	2.70	3.00	3.00	(3.10)	3.25	3.30	3.35
31	3.40	.....	4.70	.....	4.00	.....	3.00	3.00	.....	3.30	.....	3.35

NOTE.—Gage heights in parenthesis are estimated.

PIT RIVER (SOUTH FORK) NEAR IVY, CAL.

This station was established January 11, 1904, by H. E. Green and J. S. Evans. It is located 3 miles west of Ivy post-office at outlet of Jess Valley.

The gage is a 2 by 6 inch vertical plank fastened to a tree on left bank 50 feet above station. It is only read at times discharge measurements are made, as it is impossible to get an observer on account of its isolated location.

Discharge measurements are made from cable and car. The initial point for soundings is foot of post used for fastening the car on the left bank of stream. The channel is straight for 200 feet above and 80 feet below the station. The current is sluggish at low-water stage. The right bank is low and subject to overflow in high water. The bed of the stream is composed of earth and is filled with vegetation at

low-water stage. The bench mark is on large bowlder 150 feet east of cabin on the right bank and below station. It is 12.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Pit River (South Fork) near Ivy, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 11	J. S. Evans	3.60	44
February 3	do	3.30	26
February 16	do	5.70	202
February 25	do	5.20	158
March 18	do	4.20	60
April 2	do	4.25	69
May 7	do	5.60	197
May 24	do	7.80	573
June 14	S. G. Bennett and J. S. Evans	5.80	222
September 3	J. Y. Toler	4.00	29
September 16	do	4.15	31
September 24	do	4.22	37
October 1	do	4.20	38
October 12	do	4.65	75
October 20	J. Y. Toler and W. B. Clapp	4.35	48
October 24	J. Y. Toler	4.24	33
November 6	do	4.23	43
November 18	do	4.23	39
November 30	do	4.20	32
December 15	do	4.20	33

Mean daily gage height, in feet, of Pit River (South Fork) near Ivy, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.40	4.00	4.25	(4.50)	(7.30)	(5.00)	(4.50)	(4.10)	4.20	(4.25)	(4.20)
2	.....	3.30	4.05	4.25	(4.80)	(7.20)	(5.00)	(4.50)	(4.10)	(4.20)	(4.25)	(4.20)
3	.....	3.40	4.20	4.20	(5.00)	(7.00)	(4.95)	(4.50)	4.00	(4.20)	(4.25)	(4.20)
4	.....	3.40	4.30	4.30	(5.10)	(6.80)	(4.95)	(4.45)	(4.00)	(4.20)	(4.25)	(4.20)
5	.....	3.40	4.30	4.15	(5.40)	(6.60)	(4.95)	(4.45)	(4.00)	(4.20)	(4.25)	(4.20)
6	.....	3.35	4.20	4.10	(5.50)	(6.50)	(4.90)	(4.45)	(4.00)	(4.20)	4.25	(4.20)
7	.....	3.40	4.60	4.10	(5.60)	(6.40)	(4.90)	(4.40)	(4.00)	(4.20)	(4.25)	(4.20)
8	.....	3.40	5.00	4.25	(5.60)	(6.30)	(4.90)	(4.40)	(4.00)	(4.20)	(4.25)	(4.20)
9	.....	3.55	4.80	4.25	(5.70)	(6.20)	(4.85)	4.40	(4.00)	(4.20)	(4.25)	(4.20)
10	.....	3.35	4.70	(4.20)	(5.90)	(6.10)	(4.85)	4.35	(4.00)	(4.20)	(4.25)	(4.20)
11	3.60	3.40	4.50	(4.20)	(6.00)	(6.00)	(4.85)	(4.35)	(4.10)	(4.40)	(4.25)	(4.20)
12	3.60	3.30	4.40	(4.20)	(6.10)	(5.90)	(4.80)	(4.30)	(4.10)	4.65	(4.25)	(4.20)
13	3.40	3.60	4.30	(4.20)	(6.30)	(5.80)	(4.80)	4.30	(4.10)	(4.60)	(4.25)	(4.20)
14	3.40	3.40	4.15	(4.30)	(6.40)	5.80	(4.80)	(4.30)	(4.10)	(4.60)	(4.25)	(4.20)
15	3.40	3.90	4.25	(4.40)	(6.70)	(5.80)	(4.75)	(4.30)	(4.10)	(4.50)	(4.25)	(4.20)
16	3.50	5.50	4.20	(4.50)	(6.90)	(5.70)	(4.75)	(4.30)	4.15	(4.50)	(4.25)	(4.20)
17	3.45	5.05	4.20	(4.80)	(7.00)	(5.60)	(4.75)	4.30	(4.15)	(4.40)	(4.25)	(4.20)
18	3.40	4.30	4.20	(5.00)	(7.20)	(5.50)	(4.70)	(4.30)	(4.15)	(4.40)	(4.25)	(4.20)
19	3.40	3.90	4.20	(5.20)	(7.50)	(5.50)	(4.70)	(4.30)	(4.15)	(4.40)	(4.25)	(4.20)
20	3.40	3.90	4.40	(5.00)	(7.60)	(5.40)	(4.70)	4.25	(4.15)	4.35	(4.25)	(4.20)
21	3.40	3.70	4.45	(5.00)	(7.70)	(5.40)	(4.65)	(4.25)	(4.15)	(4.30)	(4.20)	(4.20)
22	3.40	5.90	4.30	(5.00)	(7.80)	(5.40)	(4.65)	(4.25)	(4.15)	(4.30)	(4.20)	(4.20)
23	3.40	5.80	4.10	(4.90)	(7.80)	(5.40)	(4.65)	(4.20)	(4.15)	(4.30)	(4.20)	(4.20)
24	3.40	5.40	4.00	(4.80)	7.80	(5.40)	(4.60)	(4.20)	4.20	4.25	(4.20)	(4.20)
25	3.30	5.25	4.20	(4.70)	(7.80)	(5.40)	(4.60)	(4.20)	(4.20)	(4.25)	(4.20)	(4.20)
26	3.25	5.45	4.20	(4.70)	(8.00)	(5.30)	(4.60)	(4.20)	(4.20)	(4.25)	(4.20)	(4.20)
27	3.20	4.80	4.30	(4.70)	(7.80)	(5.20)	(4.60)	(4.20)	(4.20)	(4.25)	(4.20)	(4.20)
28	3.20	4.20	5.30	(4.60)	(7.80)	(5.10)	(4.55)	(4.20)	(4.20)	(4.25)	(4.20)	(4.20)
29	3.20	4.00	5.30	(4.50)	(7.60)	(5.00)	(4.55)	(4.10)	(4.20)	(4.25)	(4.20)	(4.20)
30	3.25	.....	4.75	(4.40)	(7.50)	5.00	(4.55)	(4.10)	(4.20)	(4.25)	4.20	(4.20)
31	3.30	.....	4.45	.....	(7.50)	.....	(4.50)	(4.10)	.....	(4.25)	.....	(4.20)

NOTE.—Gage heights in parenthesis are estimated.

Rating table for Pit River (South Fork) near Ivy, Cal., from January 1 to June 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.20	25	4.30	74	5.40	168	6.50	316
3.30	28	4.40	80	5.50	180	6.60	332
3.40	31	4.50	86	5.60	192	6.70	350
3.50	34	4.60	94	5.70	204	6.80	368
3.60	37	4.70	102	5.80	216	6.90	386
3.70	41	4.80	110	5.90	228	7.00	406
3.80	46	4.90	118	6.00	242	7.20	446
3.90	51	5.00	128	6.10	256	7.40	488
4.00	56	5.10	138	6.20	270	7.60	532
4.10	62	5.20	148	6.30	284	7.80	576
4.20	68	5.30	158	6.40	300	8.00	625

Rating table for Pit River (South Fork) near Ivy, Cal., from July 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.00	30	4.30	45	4.60	70	4.90	100
4.10	34	4.40	52	4.70	80	5.00	110
4.20	39	4.50	60	4.80	90		

Estimated monthly discharge of Pit River (South Fork) near Ivy, Cal., for 1904.

[Drainage area, 91 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	37	25	[a] 30	1,845	0.33	0.38
February	228	28	76	4,372	.84	.91
March	158	56	82	5,042	.90	1.04
April	148	62	90	5,355	.99	1.10
May	625	86	372	22,873	4.09	4.72
June	466	128	234	13,924	2.57	2.87
July	110	60	85	5,226	.93	1.07
August	60	34	46	2,828	.51	.59
September	39	30	35	2,083	.38	.42
October	75	39	47	2,890	.52	.60
November	42	39	41	2,440	.45	.50
December	39	39	39	2,398	.43	.50
The year	625	25	98	71,276	1.08	14.70

[a] Mean for 21 days assumed as mean for entire month.

PIT RIVER NEAR CANBY, CAL.

This station was established December 26, 1903, by H. E. Green and J. S. Evans. It is located at the wagon bridge, 3½ miles southwest of Canby, Cal. The gage is a 1 by 6 inch vertical plank securely fastened to the first bridge pier from the left bank of the stream. It is read twice each day by Ernest M. Hess.

Discharge measurements are made from the bridge. The initial point for soundings is a nail in the railing post at the end of the bridge on the left bank. The channel is straight for 150 feet above and 200 feet below the station. The current is moderate at all stages. The banks are high and are not subject to overflow. The channel is rocky, but is not subject to much change. The bench mark is a

painted point on a large bowlder at the bend of the wagon road near the south end of the bridge. It is 24.90 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Pit River near Canby, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
December 27	J. S. Evans	3.60	169
1904.			
February 12	J. S. Evans	3.65	183
February 18	do	6.25	1,669
February 22	do	7.15	2,435
March 3	do	7.30	2,630
March 5	do	9.05	4,383
March 29	do	10.10	6,204
May 2	do	9.70	5,236
May 16	do	5.70	1,540
June 2	do	5.20	1,204
June 12	do	4.60	728
September 6	J. Y. Toler	2.70	9
September 19	do	2.75	16
September 22	do	2.75	19
September 26	do	2.82	20
October 3	do	3.00	41
October 7	do	3.18	48
October 13	do	3.28	76
October 21	do	3.50	128
November 4	do	3.45	110
November 9	do	3.50	117
November 22	do	3.50	127
December 6	do	3.50	106
December 10	do	3.35	82
December 20	do	3.68	213
December 29	do	3.50	131

Mean daily gage height, in feet, of Pit River near Canby, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.70	3.45	6.70	8.55	8.10	5.25	3.65	3.30	2.65	3.00	3.50	3.55
2	3.60	3.45	7.30	7.55	9.85	5.20	3.60	3.30	2.65	3.35	3.50	3.55
3	3.50	3.45	7.55	6.90	9.85	5.15	3.60	3.30	2.60	3.10	3.50	3.55
4	3.55	3.50	9.05	6.75	9.30	5.05	3.60	3.30	2.60	3.10	3.50	3.50
5	3.50	3.50	9.35	6.50	8.55	5.00	3.60	3.30	2.60	3.10	3.50	3.45
6	3.40	3.50	8.45	6.30	7.45	4.90	3.60	3.30	2.60	3.10	3.50	3.50
7	3.60	3.50	9.85	5.95	7.00	4.80	3.60	3.30	2.60	3.10	3.50	3.50
8	3.50	3.50	14.00	5.90	6.60	4.75	3.60	3.30	2.65	3.15	3.50	3.50
9	3.50	3.45	12.70	5.80	6.35	4.70	3.60	3.30	2.65	3.15	3.50	3.50
10	3.50	3.45	10.50	5.65	6.05	4.70	3.60	3.30	2.65	3.15	3.50	3.50
11	3.50	3.45	8.95	5.55	5.85	4.65	3.60	3.20	2.65	3.20	3.50	3.50
12	3.50	3.50	8.15	5.50	5.80	4.60	3.50	3.20	2.65	3.25	3.50	3.50
13	3.60	3.60	7.55	5.40	5.70	4.50	3.50	3.20	2.70	3.30	3.50	3.50
14	3.60	3.65	7.00	5.60	5.70	4.50	3.50	3.10	2.70	3.30	3.50	3.55
15	3.50	5.00	7.00	6.00	5.70	4.40	3.50	3.10	2.70	3.40	3.50	3.60
16	3.70	10.70	7.00	6.00	5.80	4.30	3.50	3.10	2.75	3.40	3.50	3.75
17	3.60	7.15	7.00	6.00	5.80	4.20	3.50	3.00	2.80	3.40	3.50	3.75
18	3.50	6.45	7.40	6.00	5.80	4.10	3.50	2.90	2.80	3.40	3.50	3.80
19	3.40	6.55	8.65	5.80	5.80	4.00	3.50	2.90	2.80	3.45	3.50	3.80
20	3.40	6.40	9.70	5.80	5.80	3.95	3.50	2.80	2.80	3.45	3.50	3.75
21	3.50	6.20	8.50	5.80	5.90	3.95	3.50	2.80	2.80	3.45	3.50	3.65
22	3.50	7.50	8.35	5.75	5.90	3.90	3.50	2.80	2.80	3.50	3.50	3.50
23	3.60	10.70	6.80	5.60	5.90	3.90	3.45	2.80	2.80	3.50	3.50	3.45
24	3.45	11.00	6.45	5.50	5.75	3.90	3.45	2.75	2.80	3.50	3.50	3.40
25	3.45	10.10	6.00	5.40	5.60	3.90	3.45	2.75	2.80	3.50	3.50	3.50
26	3.45	10.50	6.15	5.30	5.50	3.80	3.45	2.70	2.85	3.50	3.50	3.30
27	3.45	9.30	6.25	5.40	5.50	3.80	3.40	2.70	2.85	3.50	3.50	3.30
28	3.45	7.70	7.20	5.50	5.40	3.75	3.40	2.75	2.90	3.50	3.50	3.35
29	3.45	7.25	10.00	5.70	5.40	3.70	3.35	2.75	2.95	3.50	3.55	3.60
30	3.45	.....	9.80	6.70	5.35	3.70	3.35	2.70	3.00	3.50	3.55	4.60
31	3.45	.....	9.35	.....	5.30	.....	3.30	2.70	.....	3.50	.....	4.70

Rating table for Pit River near Canby, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.60	8	4.00	360	5.40	1,260	7.60	2,900
2.70	12	4.10	415	5.50	1,330	7.80	3,080
2.80	18	4.20	475	5.60	1,400	8.00	3,260
2.90	25	4.30	535	5.70	1,470	8.50	3,720
3.00	34	4.40	600	5.80	1,540	9.00	4,280
3.10	45	4.50	665	5.90	1,610	9.50	4,990
3.20	59	4.60	730	6.00	1,680	10.00	5,910
3.30	76	4.70	795	6.20	1,820	10.50	6,900
3.40	100	4.80	860	6.40	1,960	11.00	8,000
3.50	130	4.90	925	6.60	2,100	11.50	9,300
3.60	165	5.00	990	6.80	2,260	12.00	10,700
3.70	205	5.10	1,055	7.00	2,420	12.50	12,200
3.80	255	5.20	1,120	7.20	2,580	13.00	13,700
3.90	305	5.30	1,190	7.40	2,740	14.00	17,000

Estimated monthly discharge of Pit River near Canby, Cal., for 1904.

[Drainage area, 1,590 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	205	100	135	8,301	0.09	0.10
February	7,340	115	2,137	122,922	1.42	1.53
March	17,000	1,680	4,211	258,924	2.81	3.24
April	3,770	1,190	1,675	99,669	1.12	1.25
May	5,625	1,190	2,082	128,017	1.39	1.60
June	1,155	205	594	35,345	.40	.45
July	185	76	135	8,301	.09	.10
August	76	12	43	2,644	.03	.03
September	34	8	15	893	.01	.01
October	130	34	91	5,595	.06	.07
November	148	130	131	7,795	.09	.10
December	795	76	188	11,560	.13	.15
The year	17,000	8	953	689,966	.64	8.63

ASH CREEK AT ADIN, CAL.

This station was established March 13, 1904, by J. S. Evans and William Busch. It was originally located one-fourth of a mile above the town of Adin. During the summer the closing of waste gates in the dam at Adin interfered with the discharge at this point to such an extent that on August 15, 1904, the station was reestablished at a point 100 feet below the wagon bridge in the town of Adin, Cal., which is about 500 feet below the dam.

The gage is a 2 by 6 inch vertical plank fastened to a tree on left bank of the stream. The gage is read once each day by H. Williams. Discharge measurements are made from a suspension footbridge constructed with one-half-inch cables. The channel is straight for 200 feet above and 200 feet below the station. The left bank is high, but the right bank is subject to overflow from the side channel which, in flood, diverts water from above the station. The bed of the stream is gravelly and not subject to change.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Ash Creek at Adin, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
March 13	J. S. Evans	4.50	471
April 5	do	4.70	540
April 15	do	5.80	714
May 3	do	6.10	1,117
May 17	do	4.10	447
June 2	do	2.10	140
June 12	S. G. Bennett and J. S. Evans	1.10	54
August 30	J. Y. Toler	1.80	26
September 13	do	1.80	30
September 20	do	2.01	36
September 27	do	1.98	45
October 8	do	1.85	38
October 14	do	1.80	37
October 22	J. Y. Toler and W. B. Clapp	1.75	29
November 2	J. Y. Toler	1.77	33
November 10	do	1.75	33
November 24	do	1.78	42
December 7	do	1.75	36
December 21	do	1.83	41
December 28	do	1.85	42

Mean daily gage height, in feet, of Ash Creek at Adin, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	4.40	5.80	3.50	.....	.....	1.80	1.80	1.80	1.80
2	.....	.....	.....	4.50	6.00	2.00	.....	.....	1.80	1.80	1.80	1.80
3	.....	.....	.....	4.60	6.10	(a)	.....	.....	1.80	1.80	1.80	1.80
4	.....	.....	.....	4.90	6.20	.....	.....	.....	1.80	1.80	1.90	1.80
5	.....	.....	.....	4.90	6.00	.....	.....	.....	1.80	1.80	1.90	1.80
6	.....	.....	.....	4.90	5.00	.....	.....	.....	1.80	1.80	1.80	1.80
7	.....	.....	.....	4.70	5.10	.....	.....	.....	1.80	1.80	1.80	1.80
8	.....	.....	.....	4.60	5.00	.....	.....	.....	1.80	1.80	1.80	1.80
9	.....	.....	.....	4.50	4.30	.....	.....	.....	1.80	1.80	1.80	1.80
10	.....	.....	.....	4.60	4.10	.....	.....	.....	1.80	1.80	1.80	1.90
11	.....	.....	.....	4.90	4.20	.....	.....	.....	1.80	1.90	1.80	1.90
12	.....	.....	.....	5.20	4.20	1.10	.....	.....	1.80	2.00	1.80	1.90
13	.....	.....	4.50	5.30	4.00	.....	.....	.....	1.80	1.80	1.80	1.90
14	.....	.....	4.60	4.80	4.00	.....	.....	1.70	1.80	1.80	1.90	1.90
15	.....	.....	5.65	5.80	4.10	.....	.....	1.70	1.80	1.80	1.90	1.90
16	.....	.....	5.35	5.20	4.00	.....	.....	1.70	1.80	1.80	1.90	1.90
17	.....	.....	5.75	5.20	4.20	.....	.....	1.80	1.80	1.80	1.80	1.90
18	.....	.....	5.70	4.80	4.20	.....	.....	1.80	1.80	1.80	1.80	1.80
19	.....	.....	8.30	4.40	4.10	.....	.....	1.80	1.90	1.80	1.80	1.80
20	.....	.....	7.70	4.50	4.10	.....	.....	1.80	2.00	1.80	1.80	1.80
21	.....	.....	5.85	4.40	4.00	.....	.....	1.80	1.90	1.80	1.80	1.80
22	.....	.....	5.05	4.30	4.00	.....	.....	1.80	1.90	1.75	1.80	1.80
23	.....	.....	4.85	4.20	4.00	.....	.....	1.80	1.90	1.80	1.80	1.80
24	.....	.....	4.50	4.00	4.00	.....	.....	1.80	1.90	1.80	1.80	1.80
25	.....	.....	4.40	4.00	4.00	.....	.....	1.80	1.95	1.80	1.80	1.80
26	.....	.....	4.50	4.10	4.00	.....	.....	1.80	2.00	1.80	1.80	1.80
27	.....	.....	4.90	4.30	4.00	.....	.....	1.80	2.00	1.80	1.80	1.80
28	.....	.....	6.00	4.60	3.90	.....	.....	1.80	1.80	1.80	1.80	1.80
29	.....	.....	6.85	4.20	3.70	.....	.....	1.80	1.80	1.80	1.80	1.90
30	.....	.....	5.60	5.70	3.50	.....	.....	1.80	1.80	1.90	1.80	5.60
31	.....	.....	4.70	.....	3.60	.....	.....	1.80	.....	1.80	.....	5.40

[a] Dam put in creek at Adin mill one-fourth mile below station. Gage readings increased. Daily discharge interpolated between meter measurements from June 3 to August 13, inclusive.

Rating table for Ash Creek at Adin, Cal., from March 13 to June 2, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	47	2.40	182	3.80	380	5.40	688
1.10	54	2.50	195	3.90	398	5.60	735
1.20	62	2.60	208	4.00	416	5.80	785
1.30	70	2.70	221	4.10	434	6.00	835
1.40	79	2.80	234	4.20	452	6.20	885
1.50	88	2.90	247	4.30	470	6.40	935
1.60	98	3.00	260	4.40	488	6.60	985
1.70	108	3.10	275	4.50	506	6.80	1,035
1.80	118	3.20	290	4.60	524	7.00	1,085
1.90	128	3.30	305	4.70	542	7.20	1,140
2.00	138	3.40	320	4.80	560	7.40	1,200
2.10	149	3.50	335	4.90	580	7.60	1,260
2.20	160	3.60	350	5.00	600	7.80	1,320
2.30	171	3.70	365	5.20	644	8.00	1,380

Rating table for Ash Creek at Adin, Cal., from August 14 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*
1.70	28	1.90	36
1.75	29	1.95	39
1.80	31	2.00	42
1.85	33		

Estimated monthly discharge of Ash Creek at Adin, Cal., for 1904.

[Drainage area, 260 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March	1,470	488	[a] 735	45,193	2.77	3.19
April	785	416	550	32,727	2.08	2.32
May	885	335	505	31,051	1.91	2.20
June	335	50	76	4,522	.29	.32
July	45	35	40	2,460	.15	.17
August	31	28	30	1,845	.11	.13
September	42	31	33	1,964	.12	.13
October	42	29	32	1,968	.12	.14
November	36	31	32	1,904	.12	.13
December	400	31	55	3,382	.21	.24
The period				127,016		

[a] Mean for 19 days taken as mean for entire month.

PIT RIVER NEAR BIEBER, CAL.

This station was established January 22, 1904, by J. S. Evans and William Busch. It is located 12 miles below Bieber, Cal., near Muck Valley. The gage is a heavy wooden rod fastened to a large bowlder on the right bank of the stream. It is read once each day by F. H. Holabird. Discharge measurements are made from cable and car. The initial point for soundings is foot of platform at end of cable on right bank of stream. The channel is straight for 200 feet above and 300 feet below the station. The current is very sluggish at low-water stage. The banks are high and not subject to overflow. The channel is very rocky and rough, but not subject to change. The bench mark is on a large bowlder on right bank 50 feet east of pine tree to which cable is fastened. It is 12.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Pit River near Bieber, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 22	J. S. Evans	3.20	221
February 20	do	7.52	4,850
March 10	do	11.75	15,164
April 13	do	7.10	4,043
May 4	do	9.15	7,833
May 18	do	5.30	1,935
June 3	do	4.50	1,139
June 11	S. G. Bennett and J. S. Evans	4.00	712
August 29	J. Y. Toler	1.40	37
September 11	do	1.15	21
September 21	do	1.12	11
September 28	do	1.93	27
October 15	do	2.60	90
October 22	J. Y. Toler and S. G. Bennett	2.90	118
November 3	J. Y. Toler	3.00	142
November 11	do	2.95	139
November 25	do	3.05	163
December 8	do	2.71	73
December 27	do	3.45	280

Mean daily gage height, in feet, of Pit River near Bieber, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.20	9.80	8.10	8.30	5.00	2.90	2.30	1.20	1.75	3.05	3.30
2	.....	3.10	9.40	7.90	9.35	4.70	2.90	2.30	1.20	1.75	3.20	3.25
3	.....	3.20	8.30	7.80	9.30	4.50	2.90	2.30	1.20	1.75	3.00	3.20
4	.....	3.30	8.30	7.40	9.20	4.50	2.90	2.20	1.20	1.80	3.00	3.10
5	.....	3.30	7.80	7.20	8.80	4.40	2.80	2.20	1.20	1.80	2.95	2.90
6	.....	3.40	9.20	7.20	8.20	4.40	2.80	2.20	1.20	2.50	2.95	2.80
7	.....	3.30	9.60	7.20	7.80	4.20	2.80	2.20	1.20	2.50	2.90	2.70
8	.....	3.40	12.00	7.20	7.30	4.20	2.70	2.20	1.15	2.80	2.95	2.80
9	.....	3.40	12.70	7.20	6.40	4.10	2.70	2.20	1.15	2.80	3.00	2.80
10	.....	3.30	11.70	7.20	6.40	4.00	2.70	2.20	1.15	2.80	2.95	3.15
11	.....	3.40	12.00	7.20	6.10	4.00	2.50	2.20	1.15	2.50	2.95	3.20
12	.....	3.40	10.80	7.10	5.90	4.00	2.50	2.10	1.15	2.50	2.95	3.30
13	.....	3.60	9.80	7.10	5.90	4.00	2.50	2.10	1.10	2.50	2.95	3.40
14	.....	3.80	9.20	7.10	5.80	3.80	2.50	2.10	1.10	2.60	3.00	3.30
15	.....	4.10	8.60	7.00	5.80	3.80	2.50	2.00	1.10	2.60	3.00	3.30
16	.....	6.60	7.50	6.80	5.80	3.40	2.40	1.80	1.10	2.60	3.00	3.30
17	.....	9.45	7.20	6.40	5.80	3.30	2.40	1.70	1.15	2.70	3.00	3.35
18	.....	8.10	7.50	6.40	5.80	3.30	2.40	1.70	1.15	2.70	3.20	3.35
19	.....	8.10	8.20	6.50	5.80	3.20	2.40	1.50	1.20	2.75	3.20	3.40
20	.....	7.40	8.60	6.80	5.70	3.20	2.70	1.40	1.20	2.80	3.10	3.40
21	.....	7.60	8.10	6.90	5.70	3.10	2.70	1.00	1.20	2.80	3.10	3.45
22	3.20	7.80	7.80	6.40	5.60	3.00	2.60	1.20	1.20	2.90	3.00	3.50
23	3.20	9.80	7.20	6.40	5.50	2.80	2.50	1.20	1.30	3.00	3.00	3.50
24	3.30	11.30	6.80	6.20	5.50	2.80	2.50	1.30	1.50	3.10	3.00	3.60
25	3.50	10.80	6.20	6.50	5.40	2.70	2.40	1.40	1.40	3.05	3.00	3.05
26	3.50	10.10	6.10	6.40	5.40	2.90	2.40	1.40	1.60	3.05	3.05	3.50
27	3.40	9.80	7.00	7.80	5.30	2.90	2.40	1.40	1.80	3.00	3.20	3.50
28	3.30	9.30	8.20	8.10	5.20	2.80	2.30	1.40	1.95	3.00	3.25	3.45
29	3.30	9.10	8.50	8.50	5.20	2.80	2.30	1.30	1.75	2.90	3.25	3.05
30	3.20	.....	8.70	8.50	5.10	2.80	2.30	1.20	1.75	3.20	3.30	3.80
31	3.20	.....	8.40	.....	5.00	.....	2.30	1.20	.....	3.10	.....	4.80

Rating table for Pit River near Bieber, Cal., from January 22 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	10	2.60	85	4.20	870	6.40	3,210
1.10	12	2.70	96	4.30	950	6.60	3,480
1.20	14	2.80	108	4.40	1,040	6.80	3,760
1.30	16	2.90	120	4.50	1,130	7.00	4,050
1.40	18	3.00	145	4.60	1,220	7.50	4,800
1.50	20	3.10	180	4.70	1,310	8.00	5,600
1.60	23	3.20	220	4.80	1,400	8.50	6,500
1.70	26	3.30	270	4.90	1,500	9.00	7,540
1.80	30	3.40	320	5.00	1,600	9.50	8,680
1.90	35	3.50	375	5.20	1,800	10.00	9,940
2.00	40	3.60	435	5.40	2,010	10.50	11,320
2.10	45	3.70	500	5.60	2,230	11.00	12,800
2.20	50	3.80	565	5.80	2,460	11.50	14,380
2.30	57	3.90	635	6.00	2,700	12.00	16,020
2.40	65	4.00	710	6.20	2,950	12.50	17,660

Estimated monthly discharge of Pit River near Bieber, Cal., for 1904.

[Drainage area, 2,948 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January[a]	375	220	238	14,634	0.08	0.09
February	13,740	180	3,949	227,149	1.34	1.45
March	18,320	2,820	7,590	466,691	2.57	2.96
April	6,500	2,950	4,207	250,334	1.43	1.60
May	8,320	1,600	3,439	211,456	1.17	1.35
June	1,600	96	542	32,251	.18	.20
July	120	57	83	5,103	.03	.03
August	57	10	33	2,029	.01	.01
September	38	12	16	952	.01	.01
October	220	28	103	6,333	.03	.03
November	270	120	165	9,818	.06	.07
December	1,400	96	304	18,692	.10	.12
The year	18,320	10	1,722	1,245,442	.58	7.92

[a] January 1 to 21, inclusive, discharge estimated at 220 second-feet.

FEATHER RIVER AT OROVILLE, CAL.

At Oroville, where Feather River breaks from the foothills on the western slope of the Sierra Nevada into Sacramento Valley, it has a drainage area of 3,350 square miles. This station was established January 1, 1902, by S. G. Bennett. It is located at the northeast edge of the town of Oroville, Cal. Observations of the daily river height were begun January 1, 1902, using the rod of the United States Weather Bureau, which has been in place for a number of years. This is a 2-inch vertical iron pipe. Readings on this rod have been taken and reported by the United States Weather Bureau during floods when there was danger of overflow on the lower Feather and Sacramento rivers. To avoid negative readings the height as read on the gage has been increased by 2 feet. On August 11, 1904, a new set of gage rods of 2 by 8 inch timber, painted white and graduated to feet and tenths, were set to read 2 feet more than the old gage. Three of the sections are bolted to a rock, and a fourth is nailed to one of the bridge piers. The gage is read twice each day by D. G. Page. Discharge measurements are made by means of a cable and boat, located 500 feet above the gage. Flood measurements are made by means of floats. The channel is straight for 300 feet above and 100 feet below the station. It has a width of about 200 feet at ordinary stages and of about 700 feet at

flood stages. The bed of the stream is composed mainly of rock and is rough and permanent. The current is swift at ordinary stages. A standard United States Geological Survey bench mark has been sulphured in the rock at an elevation of 15.00 feet above the zero of the gage. The minimum midsummer discharge, as far as known, was in 1900, when the stream was flowing 1,123 second-feet.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Feather River at Oroville, Cal., for 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 20	W. B. Newhall	3.42	3,403
February 19	S. G. Bennett	10.70	18,715
March 31	E. C. Murphy, S. G. Bennett, and W. B. Clapp	13.40	34,000
May 30	Wm. Watson and John Tarish	9.20	12,793
June 8	C. W. McConaughy	7.60	9,319
June 10	Wm. Watson	7.20	9,186
June 18	C. W. McConaughy and John Tarish	5.70	6,368
June 23	C. W. McConaughy and Geo. J. Carr	4.90	5,269
June 30	C. W. McConaughy	4.00	4,129
July 15	do	2.95	2,862
August 12	O. W. Peterson	1.90	1,941
September 25	do	4.65	4,679
November 1	do	2.75	2,519

Mean daily gage height, in feet, of Feather River at Oroville, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.30	3.00	11.65	12.35	9.35	8.80	3.95	(2.20)	1.80	2.15	2.70	3.80
2	4.60	3.10	11.95	11.95	9.25	8.65	3.85	(2.20)	1.80	2.10	3.15	3.50
3	4.00	3.05	12.15	12.00	9.25	8.65	3.80	(2.20)	1.75	2.05	2.95	3.40
4	3.75	3.10	13.05	11.90	9.50	8.55	3.85	(2.15)	1.70	2.00	2.80	3.20
5	3.30	3.85	12.55	11.65	9.90	8.25	3.75	(2.15)	1.70	1.90	2.70	2.90
6	3.20	3.65	12.00	11.80	9.95	8.10	3.65	(2.10)	1.70	1.90	2.70	2.65
7	3.10	3.45	12.05	11.75	10.25	7.90	3.60	2.10	1.60	2.05	2.60	2.60
8	3.00	3.40	15.35	11.55	10.45	7.65	3.45	2.05	1.60	2.30	2.50	2.50
9	3.00	3.30	14.70	11.75	10.55	7.40	3.35	2.00	1.50	4.30	2.40	2.40
10	3.10	3.20	15.65	11.90	10.75	7.05	3.30	2.10	1.50	7.80	2.30	3.35
11	3.45	3.25	14.30	12.45	11.25	6.90	3.20	1.95	1.50	12.25	2.55	3.35
12	3.45	9.00	12.35	12.75	11.55	6.75	3.15	1.90	1.50	7.00	2.80	3.30
13	3.30	7.15	11.95	13.20	11.80	6.55	3.05	2.00	1.50	5.30	2.70	3.10
14	3.25	5.05	11.85	14.30	11.65	6.40	3.00	2.00	1.40	4.40	2.60	3.05
15	3.10	11.65	12.20	14.20	11.65	6.25	3.10	2.00	1.45	4.40	2.80	2.95
16	3.20	20.35	11.75	13.30	11.30	6.15	3.00	1.90	1.40	4.50	3.40	2.80
17	3.45	16.75	15.80	12.70	11.20	5.95	3.00	1.90	1.40	4.20	2.95	2.70
18	3.75	11.85	20.45	11.90	11.05	5.75	2.95	1.80	1.35	3.95	2.90	2.55

Mean daily gage height, in feet, of Feather River at Oroville, Cal., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
19	3.80	10.45	19.75	12.50	10.40	5.50	2.80	1.85	1.40	3.90	2.90	2.55
20	3.45	9.55	19.15	11.95	10.25	5.35	2.75	1.80	1.50	4.05	2.70	2.70
21	3.30	9.65	16.70	11.30	10.00	5.25	2.70	1.80	1.60	3.45	2.60	2.80
22	3.45	17.80	14.70	10.90	10.75	5.15	2.65	1.80	2.00	2.80	2.70	3.05
23	3.45	16.40	13.55	10.40	10.85	4.95	2.60	1.80	4.20	2.70	2.60	3.85
24	3.35	21.50	12.80	10.30	10.60	4.75	[a](2.55)	1.80	4.80	2.70	2.50	4.70
25	3.25	18.70	12.00	10.15	10.55	4.55	(2.50)	1.90	4.70	2.60	2.40	4.50
26	3.15	17.15	11.65	10.05	10.70	4.45	(2.45)	1.90	4.05	2.50	2.40	4.10
27	3.10	16.05	11.50	9.95	9.65	4.25	(2.40)	1.95	3.80	2.50	2.70	3.90
28	3.00	13.90	13.75	9.95	9.50	4.05	(2.35)	1.90	2.80	2.25	3.10	3.60
29	3.00	12.55	16.70	9.70	9.05	4.00	(2.30)	1.80	2.55	2.25	2.20	3.25
30	2.90	.....	15.10	9.50	9.00	4.05	(2.25)	1.80	2.20	2.35	3.30	16.95
31	2.95	.....	13.40	.....	8.90	.....	(2.25)	1.80	.....	2.50	.....	12.80

[a] July 24 to August 6, inclusive, gage heights interpolated.

Rating table for Feather River at Oroville, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	1,570	3.20	3,090	5.20	5,630	10.50	18,100
1.40	1,630	3.30	3,210	5.40	5,910	11.00	20,100
1.50	1,690	3.40	3,330	5.60	6,190	11.50	22,500
1.60	1,750	3.50	3,450	5.80	6,470	12.00	25,100
1.70	1,810	3.60	3,570	6.00	6,750	12.50	28,100
1.80	1,870	3.70	3,690	6.20	7,050	13.00	31,100
1.90	1,930	3.80	3,810	6.40	7,350	13.50	34,600
2.00	1,990	3.90	3,930	6.60	7,660	14.00	38,100
2.10	2,050	4.00	4,050	6.80	7,980	14.50	41,850
2.20	2,120	4.10	4,180	7.00	8,300	15.00	45,600
2.30	2,190	4.20	4,310	7.20	8,640	15.50	49,600
2.40	2,260	4.30	4,440	7.40	9,000	16.00	53,600
2.50	2,330	4.40	4,570	7.60	9,400	16.50	57,850
2.60	2,410	4.50	4,700	7.80	9,800	17.00	62,100
2.70	2,500	4.60	4,830	8.00	10,260	17.50	66,600
2.80	2,610	4.70	4,960	8.50	11,520	18.00	71,100
2.90	2,730	4.80	5,090	9.00	12,900	19.00	80,500
3.00	2,850	4.90	5,220	9.50	14,400	20.00	90,500
3.10	2,970	5.00	5,350	10.00	16,150	21.00	100,500

Estimated monthly discharge of Feather River at Oroville, Cal., for 1904.

[Drainage area, 3,350 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	4,830	2,730	3,296	202,663	0.98	1.13
February	105,500	2,850	27,766	1,597,118	8.29	8.94
March	95,000	22,500	39,529	2,430,543	11.80	13.60
April	40,350	14,400	24,468	1,455,947	7.30	8.14
May	24,000	12,620	17,751	1,091,466	5.30	6.11
June	12,340	4,050	7,459	443,841	2.23	2.49
July	3,990	2,155	2,910	178,929	.87	1.00
August	2,120	1,870	1,964	120,762	.59	.68
September	5,090	1,600	2,252	134,003	.67	.75
October	26,600	1,930	4,137	254,374	1.23	1.42
November	3,330	2,120	2,556	152,093	.76	.85
December	61,675	2,260	5,874	361,178	1.75	2.02
The year	105,500	1,600	11,664	8,422,917	3.48	47.13

YUBA RIVER NEAR SMARTSVILLE, CAL.

This station was established June 2, 1903, by W. H. Stearns. It is located at what is called "The Narrows," 1 mile from Smartsville, Cal., 18 miles from the Southern Pacific Railway station at Wheatland, Cal., and 20 miles from Marysville, Cal. The gage is in two sections. The lower one is bolted to the rock wall on the left bank of the river and the upper one to the right bank. Both are painted white, and are graduated to feet and tenths. The observer, J. R. McKeel, reads the gage once each day. Discharge measurements are made from a car and cable. One auxiliary cable is stretched parallel to and 100 feet upstream from the main cable, and a second one is located 150 feet below the station cable for float measurements. The initial point for soundings is on the left bank at the eyebolt to which the cable is fastened. The channel is straight for 200 feet above and 300 feet below the station, and the current is swift at all stages. In the 150 feet above the cable the stream has a fall of 0.2 foot, and of 0.9 foot in the 200 feet below. Both banks are high and rocky and are not subject to overflow. The banks widen out considerably just below the station. The bed of the stream is composed of gravel and sand—tailings from hydraulic mining—and is constantly shifting. After the rains of 1904 it was found that the bed of the stream had been lowered for an average depth of 2 feet. The bench mark is a

cross in a projecting point of rock under the cable on the right bank of the river 350 feet from the initial point for soundings. It is 38.65 feet above the zero of the gage. Frequent discharge measurements are made on account of continual changes of the river bed. These changes, however, do not materially affect discharge measurements for the same gage height.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Yuba River near Smartsville, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 11	J. R. McKeel	6.3	2,594
January 18	do	5.9	2,020
January 29	do	5.5	1,701
February 8	do	6.0	2,162
February 25	A. C. Lootz	13.5	23,380
May 10	J. R. McKeel	10.3	10,801
May 23	do	11.2	15,910
May 28	do	9.3	8,862
June 13	do	8.3	6,711
June 23	do	7.2	4,343
July 11	do	5.1	1,468
July 17	O. W. Peterson	4.4	1,049
July 25	J. R. McKeel	4.1	849
August 6	do	3.8	669
August 13	O. W. Peterson	3.7	625
August 28	J. R. McKeel	3.5	495
September 11	do	3.4	444
September 23	O. W. Peterson	4.9	1,528
September 25	J. R. McKeel	5.45	2,256
October 27	do	4.7	968
November 13	do	4.5	787
November 28	do	5.15	1,522
December 26	do	5.2	1,537
December 27	do	5.0	1,391

Mean daily gage height, in feet, of Yuba River near Smartsville, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.10	5.50	10.00	9.60	9.30	8.50	5.90	3.90	3.50	3.80	4.90	5.50
2	5.80	5.50	9.60	9.50	9.20	8.30	5.70	3.80	(3.50)	3.80	5.30	5.10
3	5.70	5.50	10.00	9.50	8.80	8.70	5.80	3.80	3.50	3.70	5.00	5.00
4	6.30	5.90	10.90	9.50	9.10	8.50	5.70	3.80	(3.50)	3.70	4.80	4.90
5	5.70	6.10	10.90	9.40	9.30	8.30	5.60	3.80	3.40	3.70	4.80	4.80
6	5.70	5.90	10.20	9.60	9.80	8.30	5.40	3.80	(3.40)	3.70	4.70	4.80
7	5.60	5.90	10.60	9.70	9.80	8.20	5.30	3.80	3.40	3.90	4.70	4.70
8	5.60	6.00	12.50	10.10	10.20	8.20	5.20	3.70	3.40	4.40	4.70	4.70
9	5.50	5.80	11.10	10.30	10.20	8.10	5.10	3.70	3.40	6.00	4.70	4.80
10	5.60	5.70	13.10	10.50	10.20	8.10	5.00	3.70	(3.40)	6.50	4.60	5.00
11	6.30	5.70	11.10	10.80	10.20	8.20	4.90	3.70	3.40	11.50	4.60	4.80
12	5.90	10.50	10.50	10.80	10.30	8.20	4.90	3.70	(3.40)	7.50	4.50	4.80
13	5.70	8.50	9.80	11.20	10.40	8.10	4.80	3.70	3.40	6.10	4.50	5.00
14	5.70	7.50	10.70	11.40	11.20	8.00	4.70	(3.70)	(3.40)	5.70	4.50	4.90
15	5.60	9.50	10.60	11.40	10.20	7.70	4.60	3.70	3.40	5.90	5.40	4.80
16	5.70	20.00	10.50	11.10	10.20	7.40	(4.50)	(3.70)	(3.40)	5.70	5.00	4.80
17	5.70	17.00	14.80	10.30	9.80	7.30	4.40	3.70	3.40	5.40	4.70	4.70
18	5.90	(12.00)	15.50	9.90	9.70	7.20	4.30	(3.60)	(3.40)	5.20	4.70	4.70
19	6.10	(10.50)	15.10	11.30	9.50	7.20	4.30	3.60	3.40	5.10	4.80	4.70
20	5.80	(9.50)	13.30	9.90	9.30	7.00	4.30	3.60	(3.40)	5.00	4.70	4.70
21	5.70	(9.50)	10.80	9.30	10.10	6.70	4.20	(3.60)	3.40	4.90	4.70	4.60
22	5.60	20.30	10.30	9.10	11.20	6.80	4.20	3.60	3.40	4.90	4.70	4.60
23	5.80	14.30	9.10	8.90	11.10	7.00	4.20	(3.60)	5.00	4.90	4.60	4.70
24	5.70	20.30	9.30	9.20	11.00	6.50	4.10	3.60	5.50	4.80	4.60	6.50
25	5.70	13.50	9.10	8.90	11.10	6.40	4.10	(3.60)	5.50	(4.70)	4.60	5.50
26	5.60	12.40	8.70	9.70	9.30	6.40	4.10	3.60	4.90	4.70	4.50	5.20
27	5.60	11.20	9.00	9.20	9.40	6.40	4.00	(3.60)	4.50	4.70	4.80	5.00
28	5.50	10.60	14.80	9.30	9.20	6.20	4.00	3.50	4.10	4.70	5.20	4.90
29	5.50	10.30	13.30	8.90	9.50	6.10	4.00	(3.50)	4.00	4.70	4.90	4.90
30	5.50	.....	11.10	8.50	9.00	5.90	3.90	3.50	3.80	4.90	5.60	12.00
31	5.50	.....	10.20	.....	8.80	.....	3.90	(3.50)	.....	4.80	.....	11.40

NOTE.—Gage heights in parenthesis are estimated.

Rating table for Yuba River near Smartsville, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.40	445	5.10	1,370	6.80	3,290	10.00	10,780
3.50	495	5.20	1,450	6.90	3,450	10.50	12,340
3.60	545	5.30	1,530	7.00	3,620	11.00	14,080
3.70	595	5.40	1,610	7.20	3,970	11.50	15,940
3.80	645	5.50	1,700	7.40	4,350	12.00	17,880
3.90	695	5.60	1,790	7.60	4,750	12.50	19,880
4.00	745	5.70	1,880	7.80	5,170	13.00	21,960
4.10	795	5.80	1,980	8.00	5,600	13.50	24,080
4.20	845	5.90	2,080	8.20	6,040	14.00	26,280
4.30	895	6.00	2,190	8.40	6,500	15.00	31,000
4.40	945	6.10	2,310	8.60	6,980	16.00	36,000
4.50	1,000	6.20	2,430	8.80	7,480	17.00	41,000
4.60	1,055	6.30	2,550	9.00	8,000	18.00	46,000
4.70	1,110	6.40	2,680	9.20	8,530	19.00	52,000
4.80	1,170	6.50	2,820	9.40	9,070	20.00	58,000
4.90	1,230	6.60	2,970	9.60	9,630		
5.00	1,300	6.70	3,130	9.80	10,200		

Estimated monthly discharge of Yuba River near Smartsville, Cal., for 1904.

[Drainage area, 1,220 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	2,550	1,700	1,924	118,302	1.58	1.82
February	59,800	1,700	14,913	857,805	12.22	13.18
March	31,500	7,230	15,399	946,848	12.62	14.55
April	15,560	6,740	10,638	633,005	8.72	9.73
May	14,800	7,480	10,561	649,371	8.66	9.98
June	7,230	2,080	4,650	276,694	3.81	4.25
July	2,080	695	1,156	71,080	.95	1.10
August	695	495	580	35,663	.48	.55
September	1,700	445	637	37,904	.52	.58
October	15,940	595	1,855	114,060	1.52	1.75
November	1,790	1,000	1,180	70,215	.97	1.08
December	17,880	1,055	2,280	140,192	1.87	2.16
The year	59,800	445	5,481	3,951,139	4.49	60.73

BEAR RIVER ABOVE WHEATLAND, CAL.

This station was established by O. W. Peterson on October 8, 1904. It is located about 800 feet below McCourtney Crossing and 8 miles above Wheatland. The gage rods are 300 feet above the station, on the left bank of the river. The gage is made of 3 by 8 inch timber, painted white, and is graduated to feet and tenths. Two of the sections are bolted to the rock and the upper section is nailed to a tree. The gage is read once each day by George W. Dunlap. Discharge measurements are made from a car and cable. An auxiliary cable is located 150 feet downstream and parallel to the large one, so that float measurements can be made at very high water. The white oak tree to which the right end of the cable is fastened is the initial point for soundings. The channel is straight for 350 feet both above and below the station. At ordinary stages the velocity is moderate. Neither bank is subject to overflow. The bed of the stream is composed of gravel and is not subject to any material change. A standard United States Geological Survey bench mark is sulphured in a hole drilled in the rock between the two upper sections of the gage. Its elevation is 12.26 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Bear River above Wheatland, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 14	W. B. Clapp and O. W. Peterson	([a])	30
October 9	O. W. Peterson	4.90	771
October 31	do	3.70	176

[a] Measurement made before gage was established.

Mean daily gage height, in feet, of Bear River above Wheatland, Cal., for 1904.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	5.50	4.50	17	3.80	3.80	3.70
2	.....	4.80	4.00	18	3.80	3.60	3.60
3	.....	4.30	3.80	19	3.70	3.60	3.60
4	.....	3.70	3.80	20	3.60	3.50	3.60
5	.....	3.70	3.70	21	3.60	3.50	3.50
6	.....	3.60	3.70	22	3.60	3.50	3.50
7	.....	3.60	3.60	23	3.60	3.50	3.80
8	.....	3.60	3.60	24	3.60	3.50	5.50
9	4.80	3.60	3.80	25	3.50	3.40	4.40
10	4.10	3.60	3.90	26	3.50	3.40	4.00
11	9.00	3.60	3.80	27	3.50	3.70	3.90
12	4.70	3.60	3.70	28	3.40	3.60	3.80
13	4.00	3.60	3.90	29	3.40	3.50	3.80
14	3.90	3.60	3.80	30	3.60	3.50	5.80
15	5.10	4.40	3.80	31	3.70	.....	8.80
16	(4.40)	4.00	3.70				

AMERICAN RIVER NEAR FAIROAKS, CAL.

This station was established November 3, 1904, by O. W. Peterson. It is located at Fairoaks Bridge, near Fairoaks. The gage is made of 2 by 8 inch timber, painted white, and is graduated to feet and tenths. It is nailed to one of the piles at the upper side at the right end of the Fairoaks Bridge. The gage is read twice each day by J. P. Jones. Discharge measurements are made from the downstream side of the bridge.

The vertical face of the right abutment is 4 feet from the initial point for soundings. The channel is straight for 400 feet above and below the station. At ordinary stages the velocity is moderate. The right bank is not subject to overflow. At times of very high water the left bank is subject to overflow and a second channel is formed. The bed of the stream is composed of gravel, and is subject to slight changes at times of high water. At ordinary stages the river is about 210 feet in width and averages over 4 feet in depth. The bench mark is a nail driven in the guard rail over the upstream center pier, and is 31.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of American River near Fairoaks, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
October 29	O. W. Peterson	2.60	887
November 3	do	2.80	1,122

Mean daily gage height, in feet, of American River near Fairoaks, Cal., for 1904.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		3.05	12	(2.40)	2.65	23	2.55	2.70
2		3.30	13	2.45	2.70	24	2.55	2.65
3		3.10	14	2.60	2.55	25	2.65	2.70
4	2.75	2.65	15	2.65	2.50	26	2.60	2.55
5	2.70	2.70	16	2.75	2.55	27	2.60	2.50
6	2.70	2.55	17	2.70	2.70	28	2.70	2.40
7	2.60	2.55	18	2.50	2.60	29	2.70	2.60
8	2.50	2.60	19	2.65	2.40	30	3.05	3.70
9	2.50	2.55	20	2.60	2.65	31		7.85
10	2.40	2.55	21	2.55	2.65			
11	(2.40)	2.60	22	2.50	2.90			

SACRAMENTO RIVER AT SACRAMENTO, CAL.

Gage height and turbidity records were taken at this station during 1904.

Mean daily gage height, in feet, of Sacramento River at Sacramento, Cal., for 1904.

[Observer, J. C. Pierson.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		13.1	25.4	24.0	20.8	20.5	15.5	10.3	9.0	9.7	11.1	11.9
2		13.0	24.5	23.8	20.8	20.4	15.3	10.2	9.0	9.5	11.3	12.4
3		13.0	24.3	23.6	20.9	21.2	15.0	10.0	8.9	9.5	11.6	12.5
4		12.8	23.9	23.3	21.0	20.5	14.7	10.0	8.9	9.4	11.6	12.2
5		13.2	23.6	23.0	21.2	20.5	14.4	9.9	8.9	9.3	11.5	11.9
6		13.4	23.4	22.9	21.4	20.4	14.2	9.9	8.8	9.2	11.2	11.5
7		13.7	23.2	22.5	22.0	20.3	13.9	10.0	8.8	9.1	11.0	11.2
8		13.8	23.0	22.4	21.8	19.9	13.8	9.9	8.7	9.3	11.0	11.0
9		13.9	23.0	22.2	21.6	19.9	13.5	9.7	8.7	10.5	10.9	10.9
10	14.1	13.7	23.0	22.2	21.7	19.9	13.3	9.6	8.7	11.2	10.8	10.8
11	14.2	13.5	22.9	22.2	21.8	19.0	13.2	9.5	8.6	13.5	10.7	10.8
12	14.3	14.8	23.6	22.0	21.8	19.5	13.0	9.5	8.6	17.8	10.6	11.2
13	14.4	19.9	23.7	22.2	22.0	19.3	12.9	9.3	8.5	16.2	10.6	11.1
14	14.2	19.4	23.7	22.2	21.1	19.2	12.6	9.6	8.5	15.1	10.5	11.3
15	13.9	18.8	24.0	22.3	21.8	19.0	12.4	10.0	8.4	13.9	10.4	11.8
16	13.6	22.4	23.8	22.1	21.8	19.1	12.3	10.0	8.4	13.3	10.6	11.9

Mean daily gage height, in feet, of Sacramento River at Sacramento, Cal., for 1904—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17	13.5	21.8	23.3	22.0	21.6	19.0	12.0	9.9	8.4	13.1	10.9	11.8
18	13.8	21.4	24.2	22.2	21.6	18.9	12.0	9.8	8.4	12.6	10.9	11.5
19	14.4	21.4	24.3	22.0	21.5	18.7	12.0	9.8	8.4	12.3	11.0	11.2
20	15.2	21.6	25.9	22.0	21.2	18.5	11.9	9.7	8.3	12.0	11.0	11.1
21	15.1	22.4	26.3	21.8	21.2	18.2	11.7	9.7	8.2	11.9	11.0	11.0
22	14.9	23.8	26.2	21.8	21.4	18.0	11.6	9.6	8.2	11.9	11.0	10.9
23	14.7	25.0	25.9	21.6	21.4	17.9	11.5	9.4	8.2	11.8	10.9	10.8
24	14.5	25.6	25.4	21.5	21.2	17.8	11.4	9.4	8.7	11.8	10.8	10.9
25	14.4	27.1	25.0	21.3	21.4	17.3	11.2	9.3	9.9	11.7	10.7	10.5
26	14.2	27.8	24.5	21.2	21.1	17.0	11.0	9.3	11.6	11.6	10.6	12.7
27	14.0	27.7	24.0	21.1	20.8	16.6	11.0	9.3	11.8	11.5	10.5	13.2
28	13.7	26.7	23.7	21.1	20.8	16.2	10.8	9.3	11.1	11.4	10.6	12.8
29	13.5	26.0	23.9	21.0	20.7	15.8	10.7	9.2	10.4	11.3	11.5	12.3
30	13.4	.....	24.4	20.8	20.7	15.7	10.6	9.1	10.0	11.1	12.0	12.0
31	13.3	.....	24.2	.....	20.6	.....	10.5	9.0	.....	11.0	.....	18.6

Daily turbidity record of Sacramento River at Sacramento, Cal., for 1904.

[Observer, J. C. Pierson.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	85	250	200	95	75	60	40	50	90	70	150
2	.....	100	250	150	90	85	65	45	45	80	100	150
3	.....	85	300	150	90	75	70	35	50	65	60	180
4	.....	110	300	120	80	90	65	40	55	85	75	140
5	.....	150	200	130	80	85	75	35	55	65	55	110
6	.....	400	250	130	95	75	75	30	60	75	60	80
7	.....	180	200	200	110	85	70	45	55	65	75	65
8	.....	180	150	200	100	80	70	40	50	65	70	65
9	.....	100	150	200	110	80	65	40	45	150	65	45
10	160	110	300	180	110	75	60	50	50	250	70	75
11	170	75	300	160	120	75	55	45	50	200	70	75
12	180	350	300	100	100	80	55	55	50	400	65	75
13	250	600	250	100	100	75	55	40	50	200	70	55
14	90	400	200	110	100	75	55	55	55	200	75	60
15	100	160	250	100	100	75	55	65	50	140	75	70
16	100	700	250	110	90	70	60	65	40	110	50	100
17	100	400	150	120	90	70	50	50	45	90	180	110
18	110	250	300	130	90	75	50	65	45	85	100	90
19	200	180	250	100	100	70	40	60	40	200	65	80
20	130	160	300	130	110	70	40	60	40	140	60	80
21	110	300	250	130	110	75	50	60	40	90	65	60
22	120	800	250	100	100	60	40	60	40	55	70	60
23	100	1,000	250	95	100	65	45	65	55	60	120	80
24	100	450	200	95	90	65	45	60	85	60	100	100
25	100	600	180	100	85	60	40	50	150	60	80	80
26	100	500	150	100	100	60	45	55	150	60	70	200
27	100	450	250	110	95	60	45	55	250	55	75	160
28	100	350	200	100	95	60	50	55	100	60	80	200
29	100	250	300	100	90	65	40	60	160	55	110	110
30	95	.....	250	90	85	65	40	60	140	60	110	200
31	90	.....	250	.....	85	.....	40	50	.....	60	.....	1,500

MOKELUMNE RIVER AT ELECTRA, CAL.

This station was established January 1, 1900, by Burr Bassell. It is located 3 miles above the wagon bridge, on the Mokelumne Hill and Jackson road. It is one-half mile below the Standard Electric Company's power house and the post-office at Electra, Cal. The gage is a large inclined timber bolted to a tree on the left bank. It is read twice each day by H. F. Vogt. Discharge measurements are made by means of a cable and car 200 feet below the gage. The initial point for soundings is the anchor sheave to which the cable is fastened on the right bank. The channel is straight for 300 feet above and for 900 feet below the station. The current is swift at all stages, but there are cross currents at extreme low water. Both banks are high and are not liable to overflow. The lower part of the right bank is composed of hard gravel. The upper part of the right bank and the entire left bank are composed of solid rock. The bed of the stream is composed of rock and gravel and is fairly permanent.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Mokelumne River at Electra, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 8	S. G. Bennett	4.25	176
February 24	W. B. Newhall	12.00	17,300
February 24	do	12.70	19,000
February 26	do	8.65	4,663
February 27	do	8.95	5,742
February 28	do	8.30	4,029
June 10	O. W. Peterson	8.15	4,460
July 19	do	4.75	500
August 16	W. B. Clapp and O. W. Peterson	4.15	96

Mean daily gage height, in feet, of Mokelumne River at Electra, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.35	3.90	7.00	7.70	7.05	7.90	6.25	4.25	4.25	4.25	4.50	4.60
2	4.30	3.90	7.10	7.55	7.00	8.00	6.00	4.20	4.30	4.55	4.55	4.50
3	4.45	4.00	7.45	7.20	7.05	8.75	5.95	4.35	4.30	4.45	4.50	4.45
4	4.55	3.90	7.35	7.00	7.45	8.60	5.70	4.30	4.15	4.35	4.40	4.40
5	4.20	4.90	8.00	7.30	7.95	8.70	5.50	4.40	4.20	4.30	4.20	4.25
6	4.10	4.85	6.80	7.25	7.95	8.80	5.60	4.55	4.15	4.25	4.15	4.25
7	4.15	5.00	7.25	7.50	8.70	8.85	5.90	4.20	4.05	5.40	4.10	4.35
8	4.20	4.45	8.85	7.40	8.70	7.80	5.70	4.30	4.15	5.65	4.15	4.30
9	4.10	4.40	7.30	7.90	9.10	7.90	5.50	4.25	4.15	5.55	4.10	4.45
10	4.20	4.45	8.85	8.05	9.50	7.95	5.60	4.35	4.15	5.65	4.25	4.40
11	4.20	4.35	7.80	8.50	9.70	7.90	5.25	4.30	4.20	8.85	4.20	4.35
12	4.20	6.55	7.25	8.30	9.90	7.95	5.10	4.35	4.15	6.75	4.20	4.25
13	4.15	6.25	7.05	9.00	9.90	8.00	5.10	3.95	4.05	6.05	4.20	4.15
14	4.15	4.55	6.90	9.20	9.40	8.05	4.95	3.95	4.20	5.70	4.20	4.20
15	4.15	4.45	7.05	9.35	9.40	7.90	4.85	3.95	4.10	5.30	4.20	4.30
16	4.20	8.45	6.95	8.00	9.15	7.75	4.75	4.10	4.25	5.15	4.10	4.35
17	4.15	6.75	7.55	7.60	9.15	7.60	4.50	3.95	4.25	5.10	4.30	4.35
18	4.20	5.95	8.85	7.80	9.20	7.55	4.35	4.00	4.20	4.95	4.15	4.25
19	4.10	5.70	9.95	8.60	8.30	7.20	4.50	4.10	4.20	4.80	4.35	4.25
20	4.70	5.50	10.50	7.80	8.20	8.30	4.60	4.00	4.05	4.50	4.20	4.35
21	4.50	5.90	9.10	7.40	8.75	7.50	4.65	4.05	4.15	4.35	4.25	4.35
22	4.45	6.50	8.25	7.55	9.50	7.20	5.00	4.15	4.15	4.25	4.25	4.35
23	4.35	9.80	8.20	7.05	9.60	7.00	4.60	4.10	4.35	4.55	4.30	4.40
24	4.30	9.55	7.95	6.90	9.50	6.85	4.50	4.10	4.55	5.05	4.30	4.50
25	4.25	11.45	7.55	7.30	9.40	6.50	4.60	4.15	4.70	4.75	4.40	4.70
26	4.20	9.45	7.35	7.75	7.85	6.50	4.45	4.05	5.20	4.95	4.40	4.45
27	4.25	9.80	7.35	7.15	7.85	6.45	4.40	4.15	4.60	4.75	4.50	4.55
28	4.20	8.00	8.35	7.00	8.25	6.20	4.40	4.10	4.25	4.60	4.85	4.60
29	4.25	7.60	9.90	6.95	8.40	6.30	4.20	4.05	4.10	4.60	4.45	4.55
30	4.20	.....	8.60	7.05	8.45	6.30	4.05	4.30	4.15	4.60	4.45	5.30
31	4.15	.....	7.95	.....	8.25	.....	4.30	4.15	.....	4.55	.....	6.35

Rating table for Mokelumne River at Electra, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.00	25	5.50	1,100	7.00	2,750	9.00	5,900
4.10	70	5.60	1,200	7.10	2,880	9.20	6,300
4.20	120	5.70	1,300	7.20	3,010	9.40	6,700
4.30	180	5.80	1,400	7.30	3,140	9.60	7,140
4.40	240	5.90	1,500	7.40	3,270	9.80	7,620
4.50	310	6.00	1,600	7.50	3,400	10.00	8,100
4.60	380	6.10	1,700	7.60	3,550	10.20	8,660
4.70	460	6.20	1,800	7.70	3,700	10.40	9,220
4.80	540	6.30	1,900	7.80	3,850	10.60	9,840
4.90	620	6.40	2,000	7.90	4,000	10.80	10,520
5.00	700	6.50	2,100	8.00	4,150	11.00	11,200
5.10	780	6.60	2,230	8.20	4,490	11.50	13,200
5.20	860	6.70	2,360	8.40	4,830	12.00	15,600
5.30	940	6.80	2,490	8.60	5,180	12.50	18,600
5.40	1,020	6.90	2,620	8.80	5,540	13.00	22,200

Estimated monthly discharge of Mokelumne River at Electra, Cal., for 1904.

[Drainage area, 537 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	460	95	157	9,654	0.29	0.33
February	13,000	5	2,491	143,284	4.64	5.00
March	9,500	2,490	4,170	256,403	7.77	8.96
April	6,600	2,620	3,780	224,926	7.04	7.85
May	7,860	2,750	5,411	332,709	10.08	11.62
June	5,450	1,800	3,607	214,631	6.72	7.50
July	1,850	42	722	44,394	1.34	1.54
August	345	15	111	6,825	.21	.24
September	860	42	165	9,818	.31	.35
October	5,630	150	827	50,850	1.54	1.78
November	580	70	189	11,246	.35	.39
December	1,950	95	315	19,369	.59	.68
The year	13,000	5	1,829	1,324,109	3.41	46.24

MOKELUMNE RIVER NEAR CLEMENTS, CAL.

This station was established by O. W. Peterson on October 28, 1904. It is located at the bridge 1 mile north of Clements. The gage is made of 3 by 8 inch timber, painted white and graduated to feet and tenths. One section is a sloping gage and is nailed to posts driven in the ground on the right bank. The other section is nailed to a pile near the sloping rod. The gage is read twice each day, except in times of low water, by Allen Gaskill, the observer. Discharge measurements are made from the downstream side of the bridge. The right end of the bridge is the initial point for soundings. The channel is straight for 150 feet above and 500 feet below the station. At ordinary stages the velocity is moderate. Neither bank is subject to overflow, but for gage heights above 15 feet the river spreads over a terrace on the left side for 200 feet. The bed of the stream is composed of gravel and silt and is subject to slight changes. Ordinarily the width of the river is about 100 feet. The head of a bolt driven in a pile to which the upper section of the gage is fastened is the bench mark. Its elevation is 9.60 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Mokelumne River near Clements, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
August 17	O. W. Peterson and W. B. Clapp		109
October 27	O. W. Peterson	4.30	334
November 4	do	4.10	280

Mean daily gage height, in feet, of Mokelumne River near Clements, Cal., for 1904.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		4.40	4.15	17		4.05	3.90
2		4.25	4.75	18		3.95	3.90
3		4.50	4.15	19		4.05	3.90
4		4.20	4.05	20		4.00	3.80
5		4.10	3.95	21		3.90	3.90
6		4.10	4.00	22		3.95	3.90
7		4.15	3.90	23		3.95	3.90
8		4.20	3.80	24		3.85	4.00
9		3.95	4.00	25		3.80	4.70
10		3.95	4.10	26		3.85	4.20
11		3.85	3.90	27		3.95	4.00
12		3.90	3.85	28	4.30	3.95	4.10
13		3.80	3.90	29	4.35	4.40	3.90
14		3.85	3.85	30	4.25	4.20	4.10
15		3.95	3.80	31	4.60		6.65
16		4.00	3.85				

STANISLAUS RIVER AT KNIGHTS FERRY, CAL.

This station was established May 19, 1903, by W. H. Stearns. The station is located 200 feet from the post-office at Knights Ferry. There is an island 800 feet above the gaging station and a dam on each channel at the head of the island. The Stanislaus Milling and Power Company's power house is on the right bank of the river below one of these dams and about 1,000 feet above the gaging station. Ordinary and low water stages are read on a 2-inch iron pipe driven into the bed of the stream. For high stages the gage is a 1 by 6 inch plank nailed to a 6 by 6 inch post on the right bank of the river. The graduations on both gages are to feet and tenths. The gage height is read twice each day by J. T. Cannon. Discharge measurements are made from a car suspended from a ⅝-inch galvanized-iron cable. Above and parallel with the main cable is another smaller one, from which a stay line can be run to the meter to hold it, in flood measurements,

against the swift current. The initial point for soundings is the eye-bolt, to which the cable is fastened on the right bank. The channel is straight for 500 feet above and below the cable. At ordinary and high stages the stream has a fall of 0.47 foot in the 500 feet above the cable, and of 0.68 foot in the 500 feet below. Both banks are composed of cemented gravel and are high. The left bank is not subject to overflow. In extreme floods the right bank has been known to be overflowed, flooding the yards and houses next the river. The bed is of gravel and is subject to some change from the addition of material which is washed down from the island above. The bench mark is a spike driven into a 6 by 6 inch redwood post near the upper section of the gage. Its elevation is 12.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Stanislaus River at Knights Ferry, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 20	F. W. Huber	6.60	345
February 14	J. T. Cannon	8.00	1,528
February 16	do	13.00	14,314
February 28	do	11.45	8,687
March 1	do	10.00	4,017
March 15	do	9.50	2,983
March 21	do	12.00	9,330
March 27	S. G. Bennett and W. B. Clapp	10.45	4,327
April 17	J. T. Cannon	10.80	5,091
May 8	do	11.55	7,608
May 22	do	12.25	8,754
May 29	do	11.20	6,215
June 19	do	10.00	3,832
June 29	do	9.00	2,408
July 9	do	8.70	1,832
July 11	do	8.10	1,291
July 22	O. W. Peterson and J. T. Cannon	7.50	798
August 3	J. T. Cannon and John McGrath	6.90	382
August 24	O. W. Peterson	6.30	84
August 28	John McGrath	6.45	210
September 11	do	6.00	74
September 29	do	6.85	330
October 23	do	7.50	744
November 6	do	7.25	445
November 27	do	6.80	292

Mean daily gage height, in feet, of Stanislaus River at Knights Ferry, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.40	6.50	9.95	10.60	10.10	10.95	8.90	7.15	6.20	7.15	7.20	7.00
2	6.40	6.45	9.65	10.45	9.85	10.85	8.70	7.05	6.20	7.30	7.20	7.10
3	6.40	6.40	9.80	10.30	9.90	11.75	8.65	7.00	6.15	7.30	7.15	7.10
4	6.40	6.45	9.80	10.30	10.45	11.20	8.65	7.10	6.15	7.10	7.10	7.05
5	6.15	7.00	9.75	10.15	10.90	(11.25)	8.95	7.20	6.10	7.05	7.10	6.95
6	6.40	6.65	9.70	10.15	11.55	11.35	8.50	7.15	6.10	7.10	7.05	6.90
7	6.30	7.20	9.75	10.40	12.10	11.20	8.50	7.15	6.10	8.15	7.00	6.90
8	6.35	7.10	10.30	10.60	11.75	11.05	8.40	7.10	6.15	8.80	7.00	6.90
9	6.30	7.00	10.00	10.95	12.15	10.60	8.35	6.95	6.10	8.35	7.00	6.95
10	6.30	6.85	10.55	11.30	12.50	10.65	8.10	6.85	6.10	8.35	6.95	6.90
11	6.35	6.80	10.40	11.50	12.40	11.15	8.05	6.80	6.05	10.35	6.90	6.85
12	6.40	9.75	10.00	11.75	12.90	11.70	8.05	6.75	6.00	9.25	6.90	6.90
13	6.40	9.00	(9.70)	12.05	12.80	10.50	8.00	6.65	6.00	8.70	6.90	6.90
14	6.40	8.00	9.45	12.30	13.10	10.40	7.85	6.60	6.00	8.40	6.85	6.90
15	6.50	7.70	9.60	11.90	12.80	10.35	7.65	6.60	6.00	8.10	6.80	6.90
16	6.45	12.80	9.45	11.15	12.65	10.30	7.70	7.00	6.00	8.00	6.80	6.90
17	6.40	9.40	9.95	10.75	12.70	10.15	(7.70)	6.85	6.05	7.75	6.85	6.90
18	6.50	8.60	10.85	10.80	12.60	10.00	7.65	6.70	6.10	7.65	6.80	6.85
19	6.55	8.25	11.85	11.60	11.55	10.00	7.70	6.60	6.05	7.55	6.90	6.80
20	6.55	8.00	15.45	10.65	11.45	9.75	7.65	6.60	6.10	7.50	6.90	6.80
21	6.50	8.10	12.90	10.20	12.00	9.85	7.65	6.60	6.05	7.55	6.90	6.80
22	6.40	8.85	11.60	10.20	12.70	9.90	7.65	6.45	6.00	7.50	6.85	6.80
23	6.60	12.20	11.50	10.00	13.20	9.85	7.60	6.40	6.15	7.55	6.80	6.80
24	6.60	15.10	11.75	9.70	13.10	9.60	(7.50)	6.35	6.80	7.45	6.80	7.00
25	6.60	14.25	11.25	9.95	12.95	9.25	(7.45)	6.45	7.25	7.40	6.75	7.20
26	6.55	11.60	10.40	10.35	11.35	(8.75)	(7.40)	6.45	7.35	7.35	6.70	7.10
27	6.50	14.05	10.40	10.05	11.30	8.25	(7.35)	6.50	7.20	7.35	6.80	6.90
28	6.50	11.20	10.45	9.90	11.10	8.50	(7.30)	6.50	6.90	7.35	6.80	6.90
29	6.50	10.35	12.70	9.80	11.40	9.00	(7.25)	6.40	6.85	7.30	7.15	6.90
30	6.50	.....	11.50	10.05	11.25	8.85	(7.20)	6.30	7.05	7.30	7.05	6.90
31	6.50	.....	11.15	.....	11.15	.....	7.15	6.35	.....	7.20	.....	8.25

NOTE.—Gage heights in parenthesis are estimated.

Rating table for Stanislaus River at Knights Ferry, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.00	60	7.60	890	9.10	2,440	11.20	6,330
6.10	70	7.70	980	9.20	2,560	11.40	6,990
6.20	80	7.80	1,070	9.30	2,680	11.60	7,700
6.30	95	7.90	1,160	9.40	2,800	11.80	8,500
6.40	125	8.00	1,250	9.50	2,950	12.00	9,300
6.50	160	8.10	1,340	9.60	3,100	12.20	10,200
6.60	200	8.20	1,440	9.70	3,250	12.40	11,200
6.70	245	8.30	1,540	9.80	3,400	12.60	12,200
6.80	295	8.40	1,640	9.90	3,550	12.80	13,250
6.90	350	8.50	1,740	10.00	3,700	13.00	14,400
7.00	410	8.60	1,840	10.20	4,040	13.50	17,400
7.10	480	8.70	1,960	10.40	4,400	14.00	20,400
7.20	550	8.80	2,080	10.60	4,800	14.50	23,400
7.30	630	8.90	2,200	10.80	5,230	15.00	26,900
7.40	710	9.00	2,320	11.00	5,730	15.50	30,400
7.50	800						

Estimated monthly discharge of Stanislaus River at Knights Ferry, Cal., including Stanislaus Water Company's ditch and Schell ditch,[a] for 1904.

[Drainage area, 935 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	257	132	199	12,236	0.21	0.24
February	27,692	217	4,712	271,037	5.04	5.44
March	30,152	2,977	6,140	377,534	6.57	7.57
April	10,807	3,357	5,389	320,668	5.76	6.43
May	15,712	3,587	9,547	587,022	10.21	11.77
June	8,418	1,611	4,558	271,220	4.88	5.44
July	2,340	624	1,295	79,626	1.39	1.60
August	630	201	372	22,873	.40	.46
September	770	145	261	15,531	.28	.31
October	4,370	545	1,174	72,186	1.26	1.45
November	613	276	412	24,516	.44	.49
December	1,540	317	436	26,809	.47	.54
The year	30,152	132	2,875	2,081,258	3.08	41.74

[a] Mean daily flow of Schell ditch estimated at 7 second-feet.

STANISLAUS WATER COMPANY'S DITCH AT KNIGHTS FERRY, CAL.

This station was established June 11, 1904, by S. G. Bennett. Measurements are made below the point where Schell ditch takes out water. The station is located about a mile below the Stanislaus Milling and Power Company's power house and about 200 feet below the place where it passes under Schell ditch flume. The gage is painted white and is graduated to feet and tenths. It is fastened to the upstream side of a small bridge and is read once each day by E. J. Coop. A meter measurement on Schell ditch 200 feet below its intake gave a discharge of about 7 second-feet, which is said to be its usual flow. In computing the estimated monthly discharge of Stanislaus River for 1904, a mean daily discharge of 7 second-feet has been used as the capacity of Schell ditch.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Stanislaus Water Company's ditch at Knights Ferry, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 22	O. W. Peterson	3.45	105
August 24	do	3.25	91
August 24	do	2.95	77
August 24	do	2.80	68
August 24	do	2.35	45
August 24	do	2.20	38

Mean daily gage height, in feet, of Stanislaus Water Company's ditch below Schell ditch intake, at Knights Ferry, Cal., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.45	3.50	3.40	3.30	2.55	1.90
2	.....	2.75	3.45	3.35	3.35	2.40	2.00
3	.....	1.50	3.40	3.30	3.30	2.40	1.90
4	.....	1.70	3.35	3.35	3.35	2.25	1.90
5	.....	2.90	.00	3.30	3.25	2.20	1.80
6	.....	3.25	.00	3.30	2.90	2.25	2.20
7	.....	3.45	.00	3.30	2.95	2.15	2.00
8	.....	3.60	.00	3.20	2.70	2.20	2.15
9	.....	3.45	3.10	3.10	2.95	2.00	2.10
10	.....	3.55	3.35	3.10	2.95	2.00	2.10
11	3.45	3.45	3.40	3.25	2.60	2.00	2.15
12	3.50	3.45	3.35	3.20	2.60	1.90	1.80
13	3.60	3.30	3.35	3.20	2.60	1.95	2.30
14	3.50	3.25	3.40	3.00	2.45	1.90	1.85
15	3.50	3.35	3.35	3.10	2.25	1.85	1.80
16	3.50	3.30	3.30	3.00	2.30	1.90	1.90
17	3.65	3.30	3.30	3.40	2.20	2.10	1.75
18	3.60	3.50	3.35	3.50	2.20	2.10	2.00
19	3.60	3.50	3.35	3.40	2.10	1.95	1.85
20	3.60	3.50	3.30	3.40	2.35	2.15	1.65
21	3.60	3.50	3.30	3.30	2.30	1.95	1.60
22	3.55	3.50	3.30	3.45	2.25	1.90	1.70
23	3.60	3.40	3.30	3.35	2.45	1.85	1.90
24	3.60	3.20	3.30	3.40	2.55	2.00	1.50
25	3.30	3.40	3.30	3.40	2.40	1.90	2.00
26	3.60	3.45	3.30	3.25	2.45	1.90	1.60
27	3.60	3.55	3.40	3.10	2.50	2.10	1.65
28	3.55	3.50	3.10	2.95	2.45	1.75	1.80
29	3.50	3.50	3.30	3.30	2.40	2.10	1.90
30	3.45	3.45	3.35	3.30	2.50	1.70	1.75
31	.....	3.40	3.35	.....	2.50	.....	2.30

Rating table for Stanislaus Water Company's ditch below Schell ditch intake, at Knights Ferry, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	12	2.10	33	2.70	63	3.20	90
1.60	15	2.20	38	2.80	68	3.30	96
1.70	18	2.30	43	2.90	73	3.40	102
1.80	21	2.40	48	3.00	78	3.50	108
1.90	24	2.50	53	3.10	84	3.60	114
2.00	28	2.60	58				

Monthly estimates of flow included in those for Stanislaus River given on page 154.

TUOLUMNE RIVER AT LAGRANGE, CAL.

This station was established August 29, 1895, by J. B. Lippincott. It is located at the wagon bridge in the town of Lagrange, Cal. It is below the high dam of the Turlock and Modesto irrigation districts, and also below the head of the canal of the Lagrange Ditch and Hydraulic Mining Company, which diverts water from the left bank of the river 15 miles above the Lagrange dam. During 1903 this canal was being repaired and for the greater part of the year carried no water; for the remainder of the year it carried only enough water to keep the flumes wet. The gage is a vertical timber fastened to the right abutment. It is read twice each day by Miss Annie P. McGinn. Discharge measurements are made from the bridge to which the gage is attached. The initial point for soundings is at the south end of the trestle approach to bridge, on the left bank of the river.

The channel is straight for 400 feet above and 600 feet below the station. It is broken by two iron piers and has a width at ordinary stages of 300 feet. During the season of low water all the water is taken out by the canals above the station. The bed of the stream is composed of gravel and is fairly permanent. The current is swift at high stages and very sluggish during low water. The discharge has gradually increased each year for the same gage heights. Both banks are high and not subject to overflow.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Tuolumne River at Lagrange, Cal., for 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 21	F. W. Huber	4.15	143
March 26	E. C. Murphy, W. B. Clapp, and S. G. Bennett	6.90	4,750
May 9	S. G. Bennett	8.64	10,531
June 8	O. W. Peterson	8.28	9,656
July 21	do	5.73	1,986
August 23	do	3.25	4.6

Mean daily gage height, in feet, of Tuolumne River at Lagrange, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.50	3.50	6.45	7.15	6.70	8.30	7.05	5.00	(3.50)	6.20	5.50	4.70
2	4.50	3.50	6.25	6.95	6.55	8.00	6.85	4.95	(3.45)	6.50	5.45	4.70
3	4.45	3.50	6.20	6.80	6.55	9.20	6.65	4.85	3.50	6.10	5.40	4.70
4	4.40	3.50	6.30	6.65	6.90	8.80	6.60	4.70	3.00	6.00	5.35	4.70
5	4.35	4.60	6.25	6.60	7.30	8.60	6.55	4.50	3.00	5.85	5.30	4.70
6	4.30	4.10	6.15	6.85	8.10	8.95	6.65	4.40	3.10	5.90	5.30	4.65
7	4.30	4.50	6.30	7.20	8.70	8.70	6.80	4.70	3.10	7.35	5.20	4.60
8	4.25	4.45	6.60	7.35	8.70	8.20	6.60	4.55	3.10	7.45	5.15	4.60
9	4.30	4.30	6.60	7.35	8.80	8.30	6.15	4.30	3.10	7.25	5.10	4.60
10	4.25	4.20	7.15	7.60	9.00	8.45	6.10	4.20	3.10	7.10	5.10	4.55
11	4.30	4.10	7.40	7.85	9.05	8.50	6.00	3.80	3.10	9.80	5.05	4.55
12	4.35	5.30	6.80	8.10	9.50	8.55	6.00	3.70	3.10	8.20	5.00	4.50
13	4.30	6.90	6.55	8.35	9.50	8.70	5.85	3.25	3.10	6.85	5.00	4.50
14	4.20	5.70	6.35	8.35	9.65	8.50	5.75	3.25	3.10	6.50	5.00	4.50
15	4.20	5.35	6.45	7.70	9.45	8.50	5.55	3.20	3.10	6.50	4.90	4.50
16	4.20	9.35	6.40	7.50	9.45	8.50	5.45	4.00	3.10	5.90	4.90	4.50
17	4.20	7.15	6.50	7.40	9.55	8.30	5.45	4.70	3.10	5.60	4.85	4.50
18	4.40	6.35	7.50	7.30	8.45	8.20	5.50	4.50	3.10	5.50	4.80	4.45
19	4.40	5.90	7.70	8.45	8.35	8.10	5.70	4.00	3.10	5.50	4.80	4.45
20	4.30	5.60	10.30	7.45	8.35	8.05	5.85	3.70	3.10	5.50	4.80	4.40
21	4.05	5.65	8.40	7.10	8.55	8.00	5.80	3.25	3.10	5.50	4.75	4.40
22	4.10	6.25	7.75	7.00	9.50	8.00	5.80	3.20	3.10	5.50	4.75	4.35
23	4.05	8.45	8.10	6.70	10.25	7.90	5.90	3.20	3.25	5.50	4.70	4.35
24	4.20	8.50	7.60	6.55	10.15	7.90	5.90	3.20	5.05	5.50	4.70	4.35
25	4.20	9.80	7.20	6.65	9.85	7.65	5.60	3.20	5.45	5.50	4.70	4.40
26	3.90	7.80	6.95	6.90	8.70	7.35	5.30	3.20	5.85	5.50	4.70	4.50
27	3.80	8.70	6.85	6.80	8.30	7.25	5.15	3.20	5.55	5.50	4.70	4.50
28	3.65	7.60	7.30	6.60	8.30	7.25	5.00	3.10	5.50	5.50	4.70	4.50
29	3.50	6.90	9.10	6.60	8.60	7.35	4.95	4.00	5.50	5.50	4.70	4.50
30	3.50	.....	8.05	6.55	8.70	7.25	4.80	(4.00)	6.10	5.50	4.70	4.50
31	3.50	.....	7.45	.....	8.35	.....	5.00	(4.00)	.....	5.50	.....	6.20

NOTE.—Gage heights in parenthesis are estimated.

Rating table for Tuolumne River at Lagrange, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.20	1	4.50	360	5.80	2,100	7.20	5,700
3.30	10	4.60	430	5.90	2,300	7.40	6,300
3.40	20	4.70	510	6.00	2,500	7.60	7,000
3.50	30	4.80	600	6.10	2,700	7.80	7,700
3.60	40	4.90	700	6.20	2,900	8.00	8,400
3.70	50	5.00	810	6.30	3,150	8.20	9,100
3.80	70	5.10	930	6.40	3,400	8.40	9,900
3.90	90	5.20	1,060	6.50	3,650	8.60	10,700
4.00	110	5.30	1,200	6.60	3,900	8.80	11,500
4.10	150	5.40	1,350	6.70	4,200	9.00	12,300
4.20	200	5.50	1,520	6.80	4,500	9.50	14,300
4.30	250	5.60	1,710	6.90	4,800	10.00	16,300
4.40	300	5.70	1,900	7.00	5,100		

Estimated monthly discharge of Tuolumne River, including Turlock and Modesto canals, at Lagrange, Cal., for 1904.[a]

[Drainage area, 1,501 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	538	331	434	26,686	0.29	0.33
February	15,882	311	4,127	237,388	2.75	2.97
March	17,665	3,275	5,949	365,790	3.96	4.56
April	10,606	4,374	6,406	381,183	4.27	4.76
May	17,850	4,405	11,692	718,913	7.79	8.98
June	13,858	6,130	9,576	569,812	6.38	7.12
July	5,530	1,046	2,970	182,618	1.98	2.28
August	1,291	325	769	47,284	.51	.59
September	3,172	97	652	38,797	.43	.48
October	15,855	1,520	3,535	217,359	2.36	2.72
November	1,520	510	808	48,079	.54	.60
December	2,900	275	463	28,469	.31	.36
The year	17,850	97	3,948	2,862,378	2.63	35.75

[a] Small amount of water diverted by mining ditch not included in this estimate.

TURLOCK CANAL AT LAGRANGE, CAL.

The Turlock canal, the property of the Turlock Irrigation district, takes water from the left bank of the Tuolumne River at the Lagrange dam. This canal was designed to carry 1,500 second-feet and to irrigate a large area of fertile land in the vicinity of Turlock and Ceres, Stanislaus County, Cal. During 1898 water was first turned into the canal in small quantities and used for puddling the banks. A record of the gage height has been kept since July, 1899. Meter measurements are made when the gaging station on the Tuolumne River at Lagrange is visited, and Morgan flume, or Flume No. 2, has been rated. It is 13.75 feet in width. The observer is J. L. Montgomery.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Turlock canal at Lagrange, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 21	F. W. Huber	1.30	49
May 8	S. G. Bennett	4.78	455
May 8	do	3.70	291
May 8	do	2.60	153
May 8	do	1.98	80
May 9	do	1.70	54
June 8	O. W. Peterson	5.08	496
August 22	do	3.90	338

Mean daily gage height, in feet, of Turlock canal at Lagrange, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.00	2.40	4.15	4.00	4.75	5.00	0.00	0.80	3.20	4.40	0.00	0.00
2	.00	3.25	4.15	4.30	4.70	4.95	a 2.60	3.60	2.60	4.40	.00	.00
3	.00	3.15	4.15	4.40	4.75	5.05	3.60	4.05	2.80	4.40	.00	.00
4	.00	3.15	4.25	4.40	4.80	5.00	4.10	4.50	2.60	4.40	.00	.00
5	.00	3.60	4.25	4.40	4.80	5.10	4.50	4.60	2.70	4.40	.00	.00
6	.00	3.60	4.25	4.45	4.85	5.10	3.35	4.60	2.60	3.90	.00	.00
7	.00	3.60	2.10	4.40	4.80	5.15	3.90	4.60	2.50	4.40	.00	.00
8	.00	3.60	b .00	4.50	4.80	5.10	4.90	4.60	2.40	4.40	.00	.00
9	.00	3.30	.00	4.60	4.70	5.10	4.80	4.60	2.40	4.40	.00	.00
10	.00	3.60	.00	4.60	4.80	4.00	4.80	4.60	2.30	3.70	.00	.00
11	.00	3.60	.00	4.60	4.90	.90	4.85	4.60	2.20	4.00	.00	.00
12	.00	3.40	.00	4.65	4.90	4.90	4.85	4.60	2.20	4.40	.00	.00
13	.00	3.80	a .85	4.70	4.95	b .00	3.95	4.60	2.20	4.40	.00	.00
14	.00	3.85	3.10	4.70	4.95	.00	4.55	4.15	2.20	4.40	.00	.00
15	.00	3.50	3.50	4.70	4.95	.00	4.60	4.10	2.15	4.40	.00	.00
16	.00	3.75	2.05	4.70	4.95	.00	4.60	4.10	2.15	4.30	.00	.00
17	.00	4.00	b .00	4.70	5.00	.00	4.80	4.60	2.55	4.30	.00	.00
18	.00	4.00	.00	4.70	5.00	.00	4.85	4.60	2.55	3.60	.00	.00
19	.00	4.00	.00	3.80	4.95	.00	.80	4.70	2.65	3.30	.00	.00
20	a 1.50	4.00	.00	4.70	5.00	.00	.80	4.60	2.60	2.80	.00	.00
21	1.50	4.00	.00	4.70	5.00	.00	.80	4.50	2.50	b .00	.00	.00
22	1.10	3.80	.00	4.70	5.05	.00	.80	4.00	2.30	.00	.00	.00
23	2.00	4.00	.00	4.70	5.00	.00	.40	3.60	2.30	.00	.00	.00
24	2.00	3.60	.00	4.70	5.00	.00	1.30	3.50	3.50	.00	.00	.00
25	2.00	3.80	.00	4.80	5.00	.00	2.60	3.45	3.20	.00	.00	.00
26	2.45	2.55	.00	4.70	5.05	.00	4.00	3.45	2.00	.00	.00	.00
27	3.25	3.20	.00	4.75	5.05	.00	4.05	3.30	4.40	.00	.00	.00
28	3.10	4.15	.00	4.70	5.05	.00	4.05	3.45	4.40	.00	.00	.00
29	3.25	4.15	.00	4.75	5.05	.00	4.70	3.45	4.40	.00	.00	.00
30	3.25	.....	.00	4.75	5.10	.00	4.80	3.60	4.40	.00	.00	.00
31	3.15	.....	a 3.00	.....	5.00	.....	.80	3.20	.....	.00	.....	.00

a Water turned in. b Water turned off.

Rating table for Turlock canal at Lagrange, Cal., from January 1 to July 1, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.00	0.0	1.40	30	2.80	179	4.20	375
.10	.5	1.50	37	2.90	192	4.30	390
.20	1.	1.60	45	3.00	205	4.40	405
.30	1.5	1.70	55	3.10	218	4.50	420
.40	2.	1.80	65	3.20	231	4.60	436
.50	2.5	1.90	75	3.30	244	4.70	452
.60	3	2.00	85	3.40	257	4.80	468
.70	4	2.10	96	3.50	270	4.90	484
.80	6	2.20	107	3.60	285	5.00	500
.90	9	2.30	118	3.70	300	5.10	516
1.00	12	2.40	129	3.80	315	5.20	532
1.10	16	2.50	141	3.90	330	5.30	548
1.20	20	2.60	153	4.00	345	5.40	564
1.30	25	2.70	166	4.10	360	5.50	580

Rating table for Turlock canal at Lagrange, Cal., from July 2 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.40	1	1.60	42	2.80	178	4.00	355
.50	2	1.70	50	2.90	192	4.10	372
.60	3	1.80	58	3.00	206	4.20	389
.70	4	1.90	67	3.10	220	4.30	406
.80	6	2.00	76	3.20	235	4.40	423
.90	9	2.10	86	3.30	250	4.50	440
1.00	12	2.20	97	3.40	265	4.60	457
1.10	16	2.30	109	3.50	280	4.70	474
1.20	20	2.40	122	3.60	295	4.80	491
1.30	24	2.50	136	3.70	310	4.90	508
1.40	29	2.60	150	3.80	325	5.00	525
1.50	35	2.70	164	3.90	340		

Monthly estimates are included in those for Tuolumne River given on page 158.

MODESTO CANAL AT LAGRANGE, CAL.

The Modesto canal is the property of the Modesto irrigation district. The water is diverted from the right side of the Tuolumne River at the Lagrange dam. This canal was designed to carry 660 second-feet and to irrigate land in the vicinity of Modesto, Stanislaus County, Cal. The principal part of the construction work was done on this canal prior to 1892, but on account of litigation the canal was not completed until April, 1903.

On April 26, 1903, a gage rod was set in and a rating made of Indian Hill flume, near Lagrange, Cal. From May 10 to June 3, and from June 10 to June 25, inclusive, boards were placed in the flumes to back the water up and keep the flumes saturated. During this time gage heights were obtained by taking the depth of the water in the canal below Indian Hill flume. The observer is Annie P. McGinn.

On July 12, 1904, the station was moved to the flume near the intake. This was done so that more gage readings and explanations of their fluctuations could be obtained, by having J. L. Montgomery, the regulator of the gates at the intake, act as gage observer. This flume is 11.85 feet in width. The gage is graduated to feet and tenths.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Modesto canal at Lagrange, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 21 [a]	F. W. Huber	2.55	170
March 26 [a]	E. C. Murphy, W. B. Clapp, and S. G. Bennett	2.60	196
May 9 [a]	S. G. Bennett	2.78	218
May 9 [b]	do	1.27	64
May 9 [b]	do	1.90	119
May 9 [b]	do	.65	24
June 8 [a]	O. W. Peterson	1.60	86
July 21 [b]	do	3.10	280
August 22 [b]	do	2.50	186

[a] Measurement made at Indian Hill flume.
[b] Measurement made at flume near intake.

Mean daily gage height, in feet, of Modesto canal at Lagrange, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.50	2.30	0.95	[a] 0.00	2.20	2.80	3.20	0.00	1.80	[a] 0.00	0.00	0.00
2	2.50	2.30	1.20	2.30	2.50	2.80	3.20	3.10	1.50	.00	.00	.00
3	2.50	2.30	1.70	2.30	2.70	3.00	3.20	3.15	1.50	.00	.00	.00
4	2.50	2.30	1.80	2.30	2.70	3.00	3.20	3.10	1.40	.00	.00	.00
5	2.50	2.60	1.80	2.30	2.70	3.00	3.20	3.05	1.50	.00	.00	.00
6	2.50	2.60	1.80	2.30	2.70	3.00	3.20	3.05	1.40	.00	.00	.00
7	2.50	2.60	2.10	2.30	2.70	3.00	3.20	3.10	1.30	.00	.00	.00
8	2.50	2.60	2.10	2.30	2.75	2.20	3.20	3.10	1.20	.00	.00	.00
9	2.50	2.60	2.10	2.30	2.00	2.20	3.20	3.05	1.20	.00	.00	.00
10	2.50	2.60	1.70	2.30	1.25	3.00	3.20	3.10	1.10	.00	.00	.00
11	2.50	2.60	1.70	2.40	2.30	3.15	3.20	3.10	.00	.00	.00	.00
12	2.50	2.70	2.00	[a] .10	2.70	3.20	3.20	3.10	.00	.00	.00	.00
13	2.50	1.60	2.30	1.20	2.90	3.10	[c] 3.25	2.95	.00	.00	.00	.00
14	2.50	[a] .05	2.30	2.35	2.90	3.10	3.25	2.70	.00	.00	.00	.00
15	2.50	.00	2.30	.45	2.90	3.15	3.25	2.65	.95	.00	.00	.00
16	2.50	.00	2.30	2.30	2.90	3.20	3.25	3.20	.95	.00	.00	.00
17	2.50	.00	2.30	2.30	2.90	3.20	3.25	3.15	1.35	.00	.00	.00
18	2.50	.00	2.40	2.60	2.90	3.20	3.25	3.15	1.35	.00	.00	.00
19	2.50	.00	2.40	2.60	2.90	3.20	3.25	3.20	1.45	.00	.00	.00
20	2.50	.00	2.40	2.60	2.90	3.20	3.25	3.20	1.40	.00	.00	.00
21	2.40	.00	2.40	2.60	1.80	3.20	3.10	2.90	1.30	.00	.00	.00
22	2.40	.00	2.60	2.65	[a] .00	3.20	3.15	2.60	1.10	.00	.00	.00
23	2.50	.00	2.60	2.70	1.35	3.20	.00	2.30	1.10	.00	.00	.00
24	2.60	.40	2.60	2.70	1.45	3.20	.60	2.20	1.85	.00	.00	.00
25	2.60	.80	2.65	2.70	1.85	3.20	.60	2.10	2.00	.00	.00	.00
26	2.60	.75	2.50	2.70	2.35	3.20	3.00	2.10	2.00	.00	.00	.00
27	2.60	.80	2.50	2.70	2.80	3.20	3.00	2.00	2.00	.00	.00	.00
28	2.50	.80	1.40	1.90	3.00	3.20	3.00	1.10	2.00	.00	.00	.00
29	2.30	.85	2.35	[b] 1.00	2.80	3.20	3.00	2.20	2.00	.00	.00	.00
30	2.30	.....	2.60	2.20	2.80	3.20	3.05	1.90	1.05	.00	.00	.00
31	2.30	.....	2.60	.....	2.80	.....	3.00	1.90	.....	.00	.....	.00

[a] Shut off water to repair canal.
[b] Water lowered to repair canal.
[c] New station established at flume near intake.

Rating table for Modesto canal at Lagrange, Cal., from July 13 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.00	0	0.90	38	1.80	112	2.70	200
.10	2	1.00	45	1.90	121	2.80	210
.20	4	1.10	53	2.00	130	2.90	220
.30	7	1.20	61	2.10	140	3.00	230
.40	11	1.30	69	2.20	150	3.10	241
.50	16	1.40	77	2.30	160	3.20	252
.60	21	1.50	85	2.40	170	3.30	263
.70	26	1.60	94	2.50	180	3.40	274
.80	32	1.70	103	2.60	190	3.50	285

Monthly estimates are included in those for Tuolumne River given on page 158.

MERCED RIVER ABOVE MERCED FALLS, CAL.

The measurement of this stream was undertaken in response to numerous requests from mining and irrigation interests. The midsummer flow of the stream is less than the combined capacity of the irrigation and power canals taking water in the vicinity of Snelling.

The station was established April 6, 1901, by H. H. Henderson. It is located 1 mile above Merced Falls. The gage is made of 2 by 4 inch board, painted white, and graduated to feet and tenths, and is bolted to iron stakes driven in the bed of the stream. The gage is read twice each day by Charles Siegfeldt. Discharge measurements are made from a car and cable. Both banks are high and rocky and are not subject to overflow. The bed of the stream is composed of gravel and is subject to change. The bench mark is ¾-inch round iron bolt set 10 inches in the slate rock on the right bank of the river. It has an elevation of 69.201 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Merced River above Merced Falls, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 10	H. H. Henderson	8.20	239
January 24	do	8.15	204
February 4	do	8.20	199
February 25	do	11.62	3,457
February 28	do	11.50	3,268
March 6	do	9.80	1,203
March 29	do	12.25	4,683
April 20	do	11.80	3,357

Discharge measurements of Merced River above Merced Falls, Cal., in 1904—Continued.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 29	H. H. Henderson	12.80	5,424
June 16	do	11.60	3,165
July 1	do	10.20	1,414
August 7	do	8.35	214
August 23	O. W. Peterson	8.32	209
August 28	H. H. Henderson	8.20	182
September 12	do	7.90	74
September 27	do	9.50	928
October 9	do	11.90	3,516
October 23	do	9.50	995
November 25	do	8.60	314
December 4	do	8.60	303

Mean daily gage height, in feet, of Merced River above Merced Falls, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.20	8.20	10.15	10.65	10.85	12.35	10.30	8.80	8.20	9.90	9.15	8.70
2	8.20	8.20	9.90	10.35	10.65	12.30	10.15	8.95	8.05	11.25	9.10	8.70
3	8.20	8.25	9.85	10.45	10.55	13.05	10.10	9.15	8.05	10.35	9.10	8.70
4	8.25	8.35	9.90	10.30	11.00	12.70	9.95	8.95	8.05	10.15	9.10	8.65
5	8.20	8.65	9.90	10.30	11.55	12.55	9.90	8.95	8.00	10.15	9.05	8.60
6	8.10	8.55	9.80	10.50	12.40	12.50	9.95	9.15	8.00	10.40	9.00	8.60
7	8.10	8.60	9.75	10.65	13.35	12.35	9.90	9.25	8.00	11.45	8.95	8.50
8	8.05	8.50	9.95	11.00	12.60	11.90	9.90	9.00	8.00	11.15	8.90	8.50
9	8.10	8.50	10.00	10.80	13.05	11.85	9.85	8.85	8.00	10.70	8.90	8.50
10	8.10	8.50	10.20	11.55	13.30	11.85	9.65	8.75	8.00	10.40	8.90	8.50
11	8.20	8.40	11.65	11.60	13.55	11.75	9.55	8.65	7.95	11.25	8.85	8.50
12	8.10	8.45	10.70	11.85	13.95	11.75	9.45	8.60	7.90	11.70	8.80	8.40
13	8.10	10.45	10.30	12.10	13.65	11.70	9.45	8.55	7.90	10.85	8.80	8.50
14	8.05	9.30	10.10	12.40	14.10	11.55	9.35	8.45	7.90	10.50	8.80	8.50
15	8.15	9.05	10.15	12.15	13.70	11.45	9.30	8.40	7.90	10.25	8.80	8.50
16	8.10	12.45	10.20	11.40	13.70	11.50	9.25	8.80	7.85	9.95	8.80	8.45
17	8.10	10.65	10.10	11.30	13.70	11.40	9.15	8.80	7.90	9.80	8.80	8.40
18	8.15	9.80	10.60	11.30	13.90	11.30	9.10	8.75	8.15	9.70	8.80	8.40
19	8.30	9.35	10.90	12.10	12.50	11.15	9.20	8.60	8.20	9.55	8.80	8.40
20	8.25	9.15	(11.30)	11.55	12.60	11.20	9.30	8.50	8.20	9.50	8.70	8.40
21	8.20	9.10	11.65	11.25	12.80	11.00	9.25	8.40	8.15	9.45	8.70	8.40
22	8.20	9.35	11.30	11.25	13.15	10.90	9.20	8.40	8.15	9.45	8.70	8.35
23	8.20	9.90	13.00	10.90	13.65	10.95	9.35	8.35	8.10	9.50	8.70	8.40
24	8.15	10.80	11.75	10.60	13.55	10.85	9.25	8.30	8.35	9.55	8.60	8.45
25	8.15	11.35	11.60	10.85	13.55	10.65	9.20	8.30	9.90	9.45	8.60	8.80
26	8.20	10.75	11.10	11.15	12.75	10.55	9.15	8.30	9.90	9.45	8.60	8.55
27	8.35	12.30	10.65	11.05	12.30	10.50	9.10	8.25	9.55	9.40	8.60	8.45
28	8.20	11.60	11.15	11.25	12.45	10.45	9.10	8.20	9.30	9.35	8.60	8.50
29	8.20	10.50	12.40	10.60	12.65	10.40	9.00	8.20	9.45	9.30	8.85	8.50
30	8.20	.....	11.55	10.60	12.50	10.35	8.90	8.30	9.80	9.30	8.75	8.50
31	8.20	.....	11.05	.....	12.45	.....	8.80	8.25	.....	9.20	.....	10.35

Rating table for Merced River above Merced Falls, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
7.80	65	9.00	565	10.10	1,450	11.40	3,000
7.90	95	9.10	630	10.20	1,550	11.60	3,300
8.00	130	9.20	700	10.30	1,650	11.80	3,630
8.10	165	9.30	770	10.40	1,760	12.00	4,000
8.20	200	9.40	845	10.50	1,870	12.20	4,400
8.30	235	9.50	920	10.60	1,980	12.40	4,800
8.40	270	9.60	1,000	10.70	2,100	12.60	5,210
8.50	310	9.70	1,085	10.80	2,220	12.80	5,630
8.60	355	9.80	1,170	10.90	2,340	13.00	6,050
8.70	400	9.90	1,260	11.00	2,460	13.50	7,200
8.80	450	10.00	1,350	11.20	2,720	14.00	8,500
8.90	505						

Estimated monthly discharge of Merced River above Merced Falls, Cal., for 1904.

[Drainage area, 1,090 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	252	148	189	11,621	0.17	0.20
February	4,900	200	1,240	71,326	1.14	1.23
March	6,050	1,128	2,265	139,269	2.08	2.40
April	4,800	1,650	2,708	161,137	2.48	2.77
May	8,780	1,925	5,797	356,444	5.32	6.13
June	6,160	1,705	3,292	195,888	3.02	3.37
July	1,650	450	909	55,892	.83	.96
August	735	200	380	23,365	.35	.40
September	1,260	80	325	19,339	.30	.33
October	3,460	700	1,511	92,908	1.39	1.60
November	665	355	471	28,026	.43	.48
December	1,705	252	361	22,197	.33	.38
The year	8,780	80	1,621	1,177,412	1.49	20.25

SAN JOAQUIN RIVER AT HERNDON, CAL.

The gage rod at this station was established by the engineering department of the Southern Pacific Railway Company in 1879. The old trestle bridge was torn down by the railroad company during 1899

and a new iron structure was erected in its place. A new gage rod, set to the datum of the old gage, was bolted to the western side of the central concrete pier. The bench mark is a nail in a post at the south end of the bridge on the west side, 0.2 foot above the ground, and marked "B. M." It is at an elevation of 24.12 feet above gage datum. The channel for some distance above and below the bridge is straight, and the water has a uniform velocity. The right bank is high, rocky, and steep. The bed of the stream is composed of small gravel and shifting sand. Because of the continual changes in the cross section, which were increased by a side channel breaking through the gravel pits on the left bank of the river just above the gaging station, meter measurements were discontinued at this station at the end of 1901.

The river stage record for 1904 has been furnished by William Hood, chief engineer of the Southern Pacific Railway Company. G. G. Nelson was the observer.

Mean daily gage height, in feet, of San Joaquin River at Herndon, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.20	2.20	4.00	5.30	5.50	8.50	6.00	4.20	3.20	4.00	3.60	3.20
2	2.20	2.20	4.00	5.30	5.40	8.50	6.00	4.00	3.20	4.20	3.50	3.20
3	2.20	2.20	4.00	5.00	5.20	10.00	5.80	4.00	3.20	4.40	3.50	3.20
4	2.20	2.20	4.00	5.00	5.20	9.50	5.80	4.20	3.20	4.50	3.50	3.10
5	2.20	2.20	4.00	5.00	6.00	8.80	5.60	4.20	3.20	4.50	3.40	3.10
6	2.20	2.20	4.00	5.00	6.50	9.00	5.50	4.20	3.00	4.80	3.40	3.10
7	2.20	2.20	4.00	5.20	6.70	8.80	5.50	4.20	3.00	5.70	3.40	3.10
8	2.20	2.20	4.00	5.50	9.00	8.00	5.50	4.20	3.00	5.70	3.40	3.10
9	2.20	2.20	4.20	6.20	8.80	7.70	5.50	4.20	3.00	5.50	3.30	3.10
10	2.20	2.20	4.20	6.80	9.00	7.50	5.20	4.30	3.00	5.50	3.30	3.10
11	2.20	2.20	6.50	7.00	9.50	7.50	5.10	4.30	3.00	5.30	3.30	3.10
12	2.20	2.20	6.80	7.20	9.70	7.50	5.00	4.10	3.00	8.00	3.30	3.10
13	2.20	2.20	6.30	7.20	10.00	7.70	5.00	4.00	2.80	6.50	3.20	3.10
14	2.20	2.20	4.50	7.30	11.20	8.00	5.00	4.00	2.80	5.50	3.20	3.10
15	2.20	2.20	4.20	7.30	11.00	7.80	5.00	4.00	2.80	5.00	3.20	3.10
16	2.20	2.30	4.20	6.80	10.70	8.00	5.00	4.00	2.80	4.70	3.20	3.10
17	2.20	5.50	4.20	6.50	10.50	7.80	5.00	4.00	2.80	4.30	3.20	3.10
18	2.20	4.00	5.00	6.30	10.20	7.50	5.00	4.00	2.80	4.30	3.20	3.10
19	2.20	3.00	4.70	6.30	9.50	7.40	5.00	4.00	2.80	4.30	3.20	3.10
20	2.50	3.20	8.50	7.30	8.50	7.20	5.00	4.00	2.80	4.20	3.20	3.10
21	2.50	3.20	6.50	6.50	8.80	7.00	5.00	3.80	2.80	4.00	3.20	3.10
22	2.40	3.20	6.00	6.30	9.30	7.00	4.80	3.70	2.80	4.00	3.20	3.10
23	2.30	3.50	5.50	6.30	10.20	7.00	4.60	3.70	2.80	4.00	3.20	3.10
24	2.30	6.00	5.30	5.50	11.00	6.70	5.00	3.60	2.80	4.00	3.20	3.10
25	2.30	6.30	5.00	6.50	10.50	6.50	5.00	3.60	5.00	4.00	3.20	3.00
26	2.30	5.80	5.00	5.50	9.50	6.20	5.00	3.50	6.80	4.00	3.20	3.00
27	2.30	6.00	4.80	5.30	8.60	6.00	5.00	3.30	5.00	3.90	3.20	3.00
28	2.20	5.30	5.00	5.30	8.50	6.00	4.70	3.30	4.80	3.90	3.20	3.00
29	2.20	4.30	8.00	5.50	9.00	6.00	4.60	3.30	4.00	3.80	3.20	3.00
30	2.20	.....	6.00	5.50	9.00	6.00	4.40	3.20	4.00	3.80	3.20	3.00
31	2.20	.....	5.50	.....	8.70	.....	4.30	3.20	.....	3.70	.....	3.20

KING RIVER NEAR SANGER, CAL.

This station was established September 3, 1895, by J. B. Lippincott. It is located 15 miles east of Sanger, Cal., near the mouth of the canyon, and is above all diversions. An automatic river stage register was installed April 18, 1903. There is also an inclined wooden gage near by from which readings were formerly taken and which is now used in checking the self-recording gage. O. G. Williams reads the gage once each day and also examines the automatic gage to see that it is in proper working order. The mean daily gage height is determined from the register sheets by the use of planimeter. Discharge measurements are made by means of a cable and car. The initial point for soundings is an eyebolt inbedded in concrete on the right bank of river. The channel is nearly straight for 300 feet above and below the station, and has a width of 180 feet at ordinary stages. The bed of the stream is composed of gravel and small bowlders and changes but little. The right bank is high and not subject to overflow. The left bank is subject to overflow during extreme high water. The current is swift. A bench mark 18.045 feet above the zero of the gage, 11 feet northwest of a sycamore tree at the upper end of the rod, is marked with a cross on the rock.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of King River near Sanger, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 30	F. W. Huber	3.94	210
March 25	E. C. Murphy and S. G. Bennett	6.60	2,038
April 27	A. C. Lootz	7.30	2,792
May 30	do	10.00	10,034
June 6	O. W. Peterson	10.85	12,827
June 30	F. R. S. Buttemer	7.80	3,704
July 19	do	6.02	1,468
July 27	do	6.50	2,008
August 8	do	6.35	1,762
August 16	do	5.60	1,292
September 8	do	4.20	312
September 29	do	6.37	1,740
October 7	do	7.25	2,704
October 15	do	6.70	2,138
October 29	do	5.47	1,054
November 8	do	4.88	712
November 17	do	4.60	520
November 25	do	4.40	445
December 2	do	4.42	445
December 9	do	4.30	368

Mean daily gage height, in feet, of King River near Sanger, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.85	3.90	5.30	7.00	7.35	10.15	7.55	5.95	4.50	6.30	5.30	4.50
2	3.85	3.90	5.30	6.95	7.20	10.40	7.45	6.15	4.45	6.40	5.30	4.45
3	3.85	3.90	5.45	6.90	7.30	11.20	7.25	5.95	4.40	6.45	5.35	4.45
4	3.85	3.90	5.55	6.75	7.75	10.95	7.15	5.75	4.40	6.50	5.20	4.40
5	3.85	4.00	5.50	6.90	8.45	10.75	7.15	5.65	4.35	6.65	5.10	4.30
6	3.90	4.05	5.30	7.10	9.15	10.65	7.15	5.70	4.30	7.30	5.05	4.25
7	3.80	5.00	5.40	7.40	9.90	10.30	7.20	6.05	4.25	7.35	5.00	4.20
8	3.80	4.10	5.55	7.60	10.05	9.70	7.20	6.25	4.25	7.35	4.95	4.20
9	3.80	4.00	5.65	7.90	10.25	9.80	6.95	6.45	4.20	7.35	4.90	4.25
10	3.80	3.90	6.05	8.20	10.45	9.85	6.75	6.20	4.15	6.95	4.90	4.25
11	3.80	4.00	6.90	8.45	10.70	10.00	6.55	5.85	4.15	8.05	4.85	4.20
12	3.80	4.05	5.90	8.65	10.95	10.05	6.60	5.55	4.10	7.95	4.80	4.20
13	3.80	4.40	(5.90)	8.95	11.15	10.10	6.45	5.35	4.10	7.15	4.80	4.30
14	3.80	4.35	(5.90)	8.75	11.25	9.80	6.30	5.40	4.10	6.80	4.75	4.20
15	3.80	4.25	(5.90)	8.75	11.25	9.70	6.15	5.55	4.10	6.65	4.70	4.20
16	3.80	4.50	6.00	8.40	11.40	9.65	6.05	5.65	4.35	6.45	4.75	4.20
17	3.80	6.90	5.95	8.00	11.45	9.45	6.00	5.65	4.35	6.20	4.75	4.20
18	3.90	5.25	6.20	8.10	11.30	9.25	6.00	5.40	4.35	6.05	4.65	4.10
19	3.90	5.00	6.65	8.50	10.30	9.00	6.05	5.20	4.30	5.95	4.65	4.10
20	3.80	4.70	8.65	8.10	10.05	9.00	6.00	5.10	4.30	5.85	4.55	4.15
21	3.70	4.70	7.20	7.65	10.15	8.60	6.00	4.95	4.30	5.85	4.60	4.15
22	3.80	5.05	6.65	7.65	10.45	8.45	6.00	4.85	4.25	5.80	4.55	4.20
23	3.90	5.05	9.70	7.25	11.10	8.50	6.25	4.75	4.25	5.80	4.55	4.15
24	4.00	5.35	7.50	7.15	11.20	8.30	6.35	4.80	5.60	5.80	(4.50)	4.15
25	3.95	(5.50)	6.85	7.45	11.25	8.10	6.25	4.85	7.50	5.75	4.40	4.45
26	3.95	5.60	6.55	7.65	10.65	7.85	6.30	4.80	6.70	5.70	4.40	4.25
27	3.95	5.40	6.55	7.35	9.95	7.80	6.40	4.85	6.25	5.60	4.40	4.20
28	3.90	6.40	7.15	7.20	10.05	7.75	6.25	4.80	6.05	5.55	4.50	4.30
29	3.90	5.55	8.75	7.05	10.35	7.75	5.95	4.75	6.15	5.45	4.50	4.20
30	3.90	.....	7.75	7.30	10.25	7.65	5.70	4.60	6.20	5.40	4.50	4.30
31	3.90	.....	7.20	.....	10.15	.....	5.65	4.55	.....	5.35	.....	4.60

NOTE.—Gage heights in parenthesis are estimated.

Rating table for King River near Sanger, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.70	130	5.00	740	6.30	1,730	8.00	3,900
3.80	165	5.10	805	6.40	1,820	8.20	4,280
3.90	200	5.20	870	6.50	1,920	8.40	4,700
4.00	240	5.30	940	6.60	2,020	8.60	5,140
4.10	280	5.40	1,010	6.70	2,120	8.80	5,600
4.20	325	5.50	1,085	6.80	2,230	9.00	6,080
4.30	370	5.60	1,160	6.90	2,340	9.50	7,460
4.40	420	5.70	1,235	7.00	2,460	10.00	9,100
4.50	470	5.80	1,310	7.20	2,700	10.50	11,150
4.60	520	5.90	1,390	7.40	2,960	11.00	13,500
4.70	570	6.00	1,470	7.60	3,240	11.50	16,300
4.80	625	6.10	1,550	7.80	3,560	12.00	19,300
4.90	680	6.20	1,640				

Estimated monthly discharge of King River near Sanger, Cal., for 1904.

[Drainage area, 1,742 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	240	130	183	11,252	0.11	0.13
February	2,340	200	618	35,548	.36	.39
March	8,080	940	2,166	133,182	1.24	1.43
April	5,960	2,175	3,549	211,180	2.04	2.28
May	15,700	2,700	10,376	637,995	5.96	6.87
June	14,550	3,320	7,563	450,030	4.34	4.84
July	3,170	1,198	1,957	120,331	1.12	1.29
August	1,870	495	1,041	64,008	.60	.69
September	3,100	280	702	41,772	.40	.45
October	3,990	975	1,901	116,888	1.09	1.26
November	975	420	620	36,893	.36	.40
December	520	302	354	21,767	.20	.23
The year	15,700	3,320	2,586	1,880,846	1.48	20.26

KING RIVER AT KINGSBURG, CAL.

This station was established in 1879 by the engineering department of the Southern Pacific Company. No meter measurements have been made since 1898, except a low-water measurement in 1902, because it was found impossible to construct a satisfactory rating table on account of the changes in gage heights, caused by the raising and lowering of the head-gate of the Peoples canal, which takes water from King River a few miles below the gaging station.

The gage heights have been furnished by William Hood, chief engineer of the Southern Pacific Railway Company. Alf. Thompson was the observer. The gage readings were discontinued March 8, 1904.

Mean daily gage height, in feet, of King River at Kingsburg, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	2.20	2.20	4.30	17	1.70	7.00	.....
2	2.20	2.20	4.20	18	1.70	5.20	.....
3	2.20	2.20	4.00	19	2.10	4.30	.....
4	2.10	2.20	4.10	20	2.10	3.90	.....
5	2.10	2.20	4.10	21	2.20	4.10	.....
6	2.00	2.50	4.00	22	2.10	4.10	.....
7	2.00	2.80	3.90	23	2.10	4.00	.....
8	2.00	2.50	.....	24	2.00	3.80	.....
9	2.00	2.80	.....	25	2.20	4.10	.....
10	2.00	2.50	.....	26	2.20	4.10	.....
11	2.00	2.40	.....	27	2.20	4.30	.....
12	1.10	2.40	.....	28	2.20	4.90	.....
13	1.80	2.50	.....	29	2.20	5.60	.....
14	1.10	3.00	.....	30	2.20	.....	.....
15	1.80	3.00	.....	31	2.20	.....	.....
16	1.70	3.40	.....				

KAWEAH RIVER BELOW THREE RIVERS, CAL.

This station was established April 29, 1903, by W. H. Stearns. It is located at a point three-fourths of a mile below the confluence of the North, Middle, and South forks. It is 17 miles from the Southern Pacific Railway station at Exeter, Tulare County, Cal., and one-fourth of a mile west of the wagon road from Exeter to Three Rivers. The gage consists of a vertical 2-inch pipe driven 3 feet into the river bed. This is used up to medium stages. For high-water readings a timber gage is securely nailed to a willow tree on the left bank of the stream. The gage is read twice each day by Miss Mary Landsdowne. Discharge measurements are made from a cable and car. The initial point for soundings is a sycamore tree on the left bank of the stream, to which the cable is fastened. The channel is straight for 400 feet above and below the station. The current is swift at high stages, but sluggish at low water. There are rapids about 400 feet above the cable. The right bank is low and subject to overflow at high stages. The left bank is high enough to prevent overflow. There are willow trees along the water's edge on both banks and a line of willows, sycamores, and cottonwoods back from the water's edge on the left bank. The bed of the stream is composed of sand, gravel, and bowlders. Some of the bowlders are 2 feet in diameter. The section is probably permanent. The bench mark is a large rock 10 feet upstream from the tree to which the cable is attached. It is marked "B. M." in black paint. Its elevation is 13.95 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Kaweah River below Three Rivers, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
January 18	G. C. Morgan	4.50	90
January 29	do	4.40	67
February 7	C. E. Bell	4.80	113
February 21	do	5.00	225
March 11	do	5.90	465
March 20	do	6.90	1,240
March 23	do	8.40	4,788
March 28	do	6.00	695
March 29	W. B. Newhall	6.75	1,195
April 17	C. E. Bell	6.50	926
June 7	F. R. S. Buttemer	6.90	1,276
June 14	do	6.65	1,016
June 21	do	6.05	692
June 28	do	5.75	493
July 7	do	5.45	377
July 14	do	5.05	204
July 15	do	5.05	222
July 22	do	4.85	145
July 30	do	4.65	101
August 6	do	4.70	127
August 14	do	4.55	92
August 21	do	4.45	77
August 28	do	4.50	87
September 3	do	4.30	57
September 11	do	4.28	53
September 23	do	4.27	47
September 27	do	5.34	310
October 3	do	5.31	303
October 9	do	5.81	495
October 11	do	7.99	2,730
October 18	do	5.35	292
October 24	do	5.20	221
November 1	do	4.90	160
November 10	do	4.70	111
November 18	do	4.67	100
November 28	do	4.60	95
December 5	do	4.55	89
December 12	do	4.53	80

Mean daily gage height, in feet, of Kaweah River below Three Rivers, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.40	5.15	5.65	6.15	6.25	7.10	5.60	(4.65)	(4.30)	(5.30)	4.90	4.60
2	4.40	5.20	5.65	6.05	6.25	7.15	(5.60)	(4.65)	(4.30)	(5.30)	(4.90)	4.60
3	4.35	5.20	5.55	6.10	6.45	7.35	(5.60)	(4.65)	(4.30)	(5.30)	(4.90)	4.60
4	4.30	5.20	5.50	6.05	6.55	7.70	(5.50)	(4.65)	(4.30)	(5.30)	(4.90)	4.60
5	4.30	5.30	5.40	6.10	6.85	7.65	(5.50)	(4.65)	(4.30)	(5.40)	(4.80)	4.55
6	4.30	5.30	5.40	6.35	7.20	7.35	(5.50)	4.70	(4.30)	(5.50)	(4.80)	4.50
7	4.30	5.30	5.40	6.55	7.80	7.15	5.45	(5.00)	(4.30)	(5.60)	(4.80)	4.50
8	4.30	5.30	5.40	6.70	7.80	6.95	(5.40)	(5.20)	(4.30)	(5.70)	(4.80)	4.55
9	4.30	5.30	5.30	6.80	7.85	6.75	(5.30)	(5.40)	(4.30)	(5.80)	(4.80)	4.50
10	4.30	5.30	5.30	6.90	7.85	6.75	(5.30)	(5.20)	(4.30)	(5.80)	(4.75)	4.60
11	4.30	5.40	5.40	6.95	8.00	7.30	(5.20)	(4.80)	(4.30)	(8.00)	(4.70)	4.55
12	4.40	5.40	5.80	7.00	7.95	7.30	(5.20)	(4.55)	(4.30)	(7.90)	(4.70)	4.55
13	4.40	5.40	5.90	7.05	8.05	6.80	(5.10)	(4.55)	(4.30)	(7.00)	(4.70)	4.50
14	4.40	5.20	5.80	6.60	8.05	6.55	5.05	4.55	(4.30)	(6.50)	(4.70)	4.50
15	4.40	5.40	5.80	6.75	8.05	6.35	5.05	(4.55)	(4.30)	(6.00)	(4.70)	4.50
16	4.40	7.80	5.70	6.85	8.05	6.45	(5.00)	(4.55)	(4.30)	(5.50)	(4.70)	4.50
17	4.40	7.35	5.65	6.50	8.10	6.50	(5.00)	(4.50)	(4.30)	(5.50)	(4.70)	4.55
18	4.50	7.30	5.80	6.50	7.90	6.40	(5.00)	(4.50)	(4.25)	(5.35)	(4.65)	4.50
19	4.50	7.20	6.10	7.50	7.65	6.20	(4.90)	(4.50)	(4.25)	(5.30)	(4.65)	4.55
20	4.50	7.20	6.20	6.75	7.70	6.10	(4.90)	(4.45)	(4.25)	(5.30)	4.65	4.50
21	4.50	7.20	6.00	6.35	7.60	6.05	(4.90)	4.45	4.25	(5.30)	4.65	4.40
22	4.50	6.80	6.00	6.35	7.55	(6.00)	4.85	(4.45)	(4.25)	(5.30)	4.60	4.50
23	4.50	6.70	8.40	6.15	7.75	(6.00)	(4.80)	(4.45)	(4.25)	(5.20)	4.60	4.50
24	4.55	6.65	6.10	6.15	7.90	(5.90)	(4.80)	(4.45)	(4.25)	5.20	4.60	4.60
25	4.60	6.40	6.00	6.40	7.90	(5.90)	(4.80)	(4.50)	(6.00)	(5.20)	4.60	4.85
26	4.60	6.30	6.10	6.45	7.65	(5.80)	(4.70)	(4.50)	(8.00)	(5.20)	4.60	4.60
27	4.60	5.90	5.90	6.50	7.40	(5.80)	(4.70)	(4.50)	5.35	(5.10)	4.60	4.65
28	4.70	5.80	6.25	6.40	7.10	5.75	(4.70)	(4.50)	(5.35)	(5.10)	4.60	4.55
29	4.70	5.70	7.15	6.30	7.15	(5.70)	(4.70)	(4.40)	(5.30)	(5.00)	4.60	4.60
30	4.70	.....	6.75	6.40	7.05	(5.70)	4.65	(4.40)	(5.30)	(5.00)	4.60	4.60
31	5.05	.....	6.15	.....	7.10	.....	(4.65)	(4.40)	.....	(4.90)	.....	5.30

From June 21 to November 28, inclusive, gage heights interpolated between those of meter measurements.

Rating table for Kaweah River below Three Rivers, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.20	40	5.30	280	6.40	850	7.50	1,950
4.30	53	5.40	315	6.50	920	7.60	2,080
4.40	66	5.50	350	6.60	1,000	7.70	2,220
4.50	80	5.60	390	6.70	1,080	7.80	2,380
4.60	95	5.70	435	6.80	1,170	7.90	2,550
4.70	115	5.80	485	6.90	1,260	8.00	2,730
4.80	135	5.90	540	7.00	1,360	8.10	2,920
4.90	160	6.00	600	7.10	1,470	8.20	3,120
5.00	190	6.10	660	7.20	1,580	8.30	3,370
5.10	220	6.20	720	7.30	1,700	8.40	3,700
5.20	250	6.30	780	7.40	1,820		

Estimated monthly discharge of Kaweah River below Three Rivers, Cal., for 1904.

[Drainage area, 520 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	205	53	78	4,796	0.15	0.17
February	2,380	235	729	41,933	1.40	1.50
March	1,525	280	640	39,352	1.23	1.42
April	1,415	630	968	57,600	1.86	2.08
May	2,920	750	2,054	126,296	3.95	4.55
June	2,220	435	1,052	62,598	2.02	2.25
July	390	105	220	13,527	.42	.48
August	315	60	108	6,641	.21	.24
September	2,730	46	190	11,306	.37	.41
October	2,730	160	511	31,420	.98	1.13
November	160	95	117	6,962	.22	.25
December	280	66	95	5,841	.18	.21
The year	2,920	46	564	408,272	1.08	14.69

TULE RIVER NEAR PORTERSVILLE, CAL.

The gaging station is located about 8 miles east of Portersville at a point just below the wagon bridge near McFarland ranch and about 1 mile above the mouth of South Fork of Tule River. The station was established April 8, 1901. The gage rod is situated on the right bank of the river 100 feet below the bridge. The bench mark is a cross on the top of a large bowlder on the right bank of the river between the cable and the bridge and is 13.10 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Tule River near Portersville, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 1	F. W. Huber	1.28	36
April 1	W. B. Newhall	2.86	342
July 2	F. R. S. Buttemer	1.25	30
July 20	do	1.00	16
July 28	do	.90	10.2
August 17	do	.85	7.9
September 9	do	.76	6.9
October 6	do	1.24	30
October 30	do	1.25	31
November 15	do	1.20	26
November 29	do	1.18	25
December 15	do	1.25	27

Mean daily gage height, in feet, of Tule River near Portersville, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.20	1.20	1.90	2.90	2.50	2.10	1.20	0.85	0.85	1.20	1.25	1.20
2	1.20	1.20	1.90	2.80	2.60	2.05	1.15	.85	.80	1.20	1.30	1.20
3	1.20	1.20	1.85	2.70	2.60	2.00	1.15	.85	.80	1.20	1.30	1.20
4	1.20	1.20	1.85	2.70	2.60	2.00	1.20	.85	.80	1.20	1.30	1.20
5	1.20	2.00	1.85	2.75	2.70	2.00	1.20	.90	.80	1.20	1.30	1.20
6	1.20	1.80	1.70	2.80	2.80	1.95	1.15	.90	.80	2.00	1.30	1.20
7	1.20	1.60	1.70	2.80	2.80	1.90	1.15	.90	.80	1.60	1.30	1.20
8	1.20	1.40	1.60	2.65	2.80	1.85	1.15	.90	.80	1.40	1.25	1.20
9	1.20	1.35	1.60	2.45	2.80	1.80	1.15	.90	.80	1.80	1.25	1.25
10	1.20	1.35	1.60	2.60	2.85	1.75	1.10	.85	.80	1.50	1.25	1.25
11	1.20	1.35	2.35	2.80	2.85	1.75	1.10	.85	.80	1.70	1.20	1.25
12	1.20	1.35	2.00	2.75	2.90	1.70	1.10	.85	.80	2.30	1.20	1.25
13	1.20	1.80	1.90	2.75	2.90	1.65	1.05	.85	.80	1.80	1.20	1.25
14	1.20	1.60	1.85	2.75	2.90	1.60	1.05	.85	.80	1.70	1.20	1.25
15	1.20	1.45	1.90	2.70	2.85	1.55	1.05	.85	.80	1.60	1.20	1.25
16	1.15	4.10	2.00	2.60	2.80	1.50	1.05	.85	.80	1.55	1.20	1.25
17	1.15	3.10	2.00	2.50	2.75	1.45	1.00	.85	.80	1.50	1.20	1.25
18	1.40	2.10	2.10	2.40	2.65	1.40	1.00	.85	.85	1.45	1.20	1.25
19	1.30	1.90	2.10	3.15	2.60	1.40	1.00	.80	.85	1.40	1.20	1.25
20	1.30	1.85	3.00	2.90	2.55	1.40	1.00	.80	.90	1.35	1.20	1.25
21	1.30	1.80	2.90	2.70	2.50	1.40	.95	.80	.90	1.35	1.20	1.30
22	1.30	1.75	2.40	2.60	2.45	1.40	.95	.80	.95	1.30	1.20	1.30
23	1.30	1.70	6.15	2.50	2.40	1.35	.95	.85	.95	1.30	1.20	1.35
24	1.25	1.65	3.20	2.40	2.40	1.35	.95	.85	1.00	1.30	1.20	1.40
25	1.25	1.65	2.70	2.40	2.35	1.30	.90	.90	2.10	1.30	1.20	1.65
26	1.25	1.60	2.50	2.70	2.30	1.30	.90	.90	1.70	1.30	1.20	1.45
27	1.20	1.60	2.40	2.60	2.30	1.25	.90	.90	1.55	1.25	1.20	1.40
28	1.20	2.70	3.20	2.55	2.30	1.25	.90	.95	1.40	1.25	1.20	1.35
29	1.20	2.00	3.80	2.55	2.25	1.20	.85	.95	1.30	1.25	1.20	1.35
30	1.20	.....	3.70	2.50	2.20	1.20	.85	.90	1.25	1.25	1.20	1.30
31	1.20	.....	3.30	.....	2.10	.....	.85	.85	.....	1.25	.....	1.70

Rating table for Tule River near Portersville, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.80	7	2.00	132	3.20	450	4.60	1,180
.90	10	2.10	150	3.30	490	4.80	1,300
1.00	15	2.20	170	3.40	530	5.00	1,420
1.10	21	2.30	190	3.50	575	5.20	1,560
1.20	28	2.40	210	3.60	625	5.40	1,700
1.30	37	2.50	235	3.70	675	5.60	1,850
1.40	47	2.60	260	3.80	725	5.80	2,010
1.50	58	2.70	285	3.90	775	6.00	2,170
1.60	70	2.80	315	4.00	830	6.50	2,620
1.70	83	2.90	345	4.20	940	7.00	3,120
1.80	98	3.00	380	4.40	1,060	7.50	3,670
1.90	115	3.10	415				

Estimated monthly discharge of Tule River near Portersville, Cal., for 1904.

[Drainage area, 437 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	47	28	30	1,845	0.07	0.08
February	885	28	121	6,960	.28	.30
March	2,305	70	283	17,401	.65	.75
April	432	210	279	16,602	.64	.71
May	345	150	262	16,110	.60	.69
June	150	28	74	4,403	.17	.19
July	28	8	17	1,045	.04	.05
August	12	7	9	553	.02	.02
September	150	7	20	1,190	.05	.06
October	190	28	55	3,382	.13	.15
November	37	28	30	1,785	.07	.08
December	83	28	37	2,275	.08	.09
The year	2,305	7	101	73,551	.23	3.17

KERN RIVER NEAR BAKERSFIELD, CAL.

This station, established in 1893 by Walter James, chief engineer of the Kern County Land Company, is located at what is known as "first point of measurement," 5 miles above Bakersfield and at the mouth of the canyon of the river. Regular meter measurements are taken, and an automatic gage records daily fluctuations of the river heights. A. K. Warren, the engineer in charge of this work for the Kern County Land Company, attends to the discharge measurements with accuracy and precision, and furnishes the Geological Survey with the final results.

Mean daily discharge, in second-feet, of Kern River near Bakersfield, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	193	203	451	1,182	875	2,130	915	553	327	415	317	263
2	188	206	396	1,050	856	2,173	918	607	329	421	316	265
3	181	214	394	956	825	2,526	977	547	304	420	326	260
4	176	219	380	951	852	2,941	895	493	275	421	335	255
5	186	220	406	926	861	2,814	854	470	260	431	330	269
6	188	243	433	935	952	2,578	809	500	242	466	322	246
7	196	238	431	984	1,140	2,452	760	497	227	506	319	228
8	183	233	413	1.022	1,341	2.139	772	559	229	561	297	211
9	184	242	403	1,048	1,488	1,859	766	567	218	568	291	221
10	190	232	414	1,048	1,548	1,786	737	594	214	595	285	231
11	191	222	410	1,106	1,645	1,832	689	556	209	569	277	232
12	199	226	455	1,133	1,820	1,896	668	504	207	575	274	230
13	198	247	399	1,175	2,036	1,909	658	459	201	602	272	230
14	200	256	446	1,203	2,216	1,854	624	432	194	551	274	240
15	195	287	445	1,177	2,324	1,763	564	477	195	528	279	240
16	194	274	494	1,177	2,411	1,764	541	516	242	498	276	234
17	209	821	537	1,079	2,467	1,766	525	500	246	490	277	228
18	219	743	523	1,019	2,616	1,717	504	516	239	433	270	225
19	198	512	527	1,012	2,563	1,573	510	450	248	394	271	225
20	181	421	674	1,107	2,188	1,426	510	419	245	378	266	225
21	165	377	1,000	1,017	1,961	1,410	487	396	218	369	274	213
22	158	363	777	962	1,857	1,269	476	363	200	356	275	224
23	173	388	872	934	1,846	1,230	494	328	210	349	275	234
24	204	407	1,085	838	2,211	1,258	516	339	199	337	280	243
25	231	427	842	814	2,627	1,252	566	329	211	349	273	249
26	229	386	720	868	2,737	1,128	590	380	352	353	263	262
27	225	392	739	884	2,441	1,070	587	384	498	358	271	239
28	218	439	861	852	2,107	1,025	571	490	457	345	260	237
29	207	598	1,574	846	2,035	945	542	480	415	325	266	266
30	190	.....	1,759	849	2,111	899	520	413	405	314	263	255
31	193	.....	1,408	.....	2,118	.....	483	366	.....	313	.....	295

Estimated monthly discharge of Kern River near Bakersfield, Cal., for 1904.

[Drainage area, 2,345 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	241	156	195	11,990	0.08	0.09
February	1,403	199	346	19,902	.15	.16
March	2,456	351	667	41,012	.28	.32
April	1,295	796	1,005	59,802	.43	.48
May	2,932	810	1,841	113,199	.79	.91
June	3,167	868	1,746	103,894	.74	.83
July	992	441	646	39,721	.28	.32
August	652	310	467	28,715	.20	.23
September	524	187	267	15,888	.11	.12
October	666	303	438	26,932	.19	.22
November	342	249	286	17,018	.12	.13
December	350	208	241	14,819	.10	.12
The year	3,167	156	679	492,892	.29	3.93

STATIONS IN YOSEMITE VALLEY, CALIFORNIA.

During the summer of 1904 the commissioners of Yosemite Valley were desirous of having discharge stations established on several of the principal streams in the Yosemite Valley. The hydrographic branch of the Geological Survey agreed to establish these stations, furnish the necessary instruments for making the discharge measurements, make all office computations, and compile the records, the commissioners to furnish the assistant to do the field work. Stations were established June 9–11, 1904, on the Merced River at the bridge near the Sentinel Hotel; on the Yosemite Creek at bridge between Yosemite post-office and Yosemite Falls, and on Tenaya Creek at bridge between Yosemite post-office and Mirror Lake. The commissioners detailed Mr. N. W. Currie to take charge of the field work, which consisted of making weekly discharge measurements and reading the gages daily. Mr. Currie made one discharge measurement at each of the stations after they were installed and kept daily gage readings to September 24, 1904. He then stopped the work entirely, but failed to notify the hydrographer in charge until December 20, when he was asked to send his records to the hydrographer for compilation. Mr. Currie then stated that this extra work was put upon him in connection with his duties as electrician; and as he received no compensation for it, he discontinued the work upon the advice and consent of the

guardian of the park. It was hoped that a sufficient number of measurements would have been made during the past summer to have rated these streams, so that by keeping a continuous gage record the daily discharge could be published weekly in the daily papers throughout the State as a matter of interest to parties who desire to visit the valley at a time when the streams are discharging in considerable volume and when the several falls are seen to the best advantage. These measurements will be continued another summer.

MERCED RIVER NEAR SENTINEL HOTEL, YOSEMITE VALLEY, CALIFORNIA.

This station was established July 11, 1904, by E. A. Chandler and N. W. Currie. It is located at the wagon bridge near the Sentinel Hotel. The gage is a 1 by 6 inch vertical timber, painted white, and graduated to feet and tenths. It is securely fastened to a masonry abutment on west bank. Discharge measurements are made from lower side of bridge. The distance across the stream is marked by nails in the floor of the bridge every 5 feet. The initial point for soundings is stream face of abutment on right bank. The channel is straight for a distance of 150 feet above and 50 feet below station. The current is sluggish. The right bank is low and subject to overflow. The left bank is high and above high water. The bed of the stream is composed of coarse gravel and sand, with small bowlders, and is not subject to much change. The bench mark is heads of two large nails driven into stream face of bridge-seat timber on the left abutment. Its elevation is 14.64 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Merced River near Sentinel Hotel, Yosemite Valley, California, in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 11	A. E. Chandler	4.60	555
July 18	N. W. Currie	4.39	431

Mean daily gage height, in feet, of Merced River near Sentinel Hotel, Yosemite Valley, California, in 1904.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	4.20	3.45	17	4.30	4.00	3.60
2	.....	4.45	3.40	18	4.40	3.90	3.60
3	.....	4.10	3.40	19	4.50	3.75	3.50
4	.....	4.10	3.40	20	4.50	3.75	3.45
5	.....	4.40	3.35	21	4.48	3.70	3.40
6	.....	4.60	3.35	22	4.70	3.60	3.40
7	.....	4.30	4.30	23	4.60	3.55	3.50
8	.....	4.10	4.30	24	4.48	3.55	4.20
9	.....	4.00	3.30	25	4.40	3.50	.....
10	.....	3.90	3.30	26	4.40	3.50	.....
11	4.60	3.90	3.30	27	4.35	3.55	.....
12	4.70	3.80	3.30	28	4.25	3.60	.....
13	4.57	3.75	3.30	29	4.10	3.55	.....
14	4.50	3.80	3.30	30	4.00	3.50	.....
15	4.40	4.15	3.35	31	4.00	3.48	.....
16	4.30	4.05	3.60				

TENAYA CREEK AT YOSEMITE VALLEY, CALIFORNIA.

This station was established July 11, 1904, by A. E. Chandler and N. W. Currie. It is located by the wagon bridge about 2 miles from Yosemite, Cal. The gage is a 1 by 6 inch vertical timber, painted white, and graduated to feet and tenths. It is securely fastened to the bridge stringer on upper side of bridge 9 feet from left abutment. Discharge measurements are made from the bridge. The distance across the stream is marked by nails in the bridge stringer every 5 feet. The initial point for soundings is the stream face of the abutment on the right bank. The channel is straight for 200 feet above and 200 feet below the station. Both banks are above high water. The bed of the stream is composed of small granite fragments and is not subject to change. The bench mark is formed by the heads of two nails in the top of the bridge stringer near the gage. Its elevation is 12.70 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Tenaya Creek at Yosemite Valley, California, in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 11	N. W. Currie	4.42	85
July 19	do	4.00	45

Mean daily gage height, in feet, of Tenaya Creek at Yosemite Valley, California, in 1904.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1		3.80	3.40	17	4.08	3.70	3.40
2		3.85	3.40	18	4.02	3.60	3.40
3		3.70	3.40	19	4.00	3.55	3.40
4		3.90	3.40	20	4.00	3.50	3.40
5		3.75	3.40	21	4.00	3.50	3.40
6		3.70	3.40	22	4.00	3.50	3.40
7		3.70	3.40	23	3.90	3.50	
8		3.60	3.40	24	3.90	3.50	4.40
9		3.60	3.38	25	3.90	3.50	
10		3.60	3.38	26	3.85	3.45	
11	4.40	3.60	3.40	27	3.80	3.45	
12	4.40	3.50	3.40	28	3.80	3.45	
13	4.30	3.50	3.40	29	3.75	3.40	
14	4.20	3.50	3.40	30	3.70	3.40	
15	4.20	3.80	3.40	31	3.70	3.40	
16	4.10	3.80	3.40				

YOSEMITE CREEK AT YOSEMITE VALLEY, CALIFORNIA.

This station was established July 9, 1904, by A. E. Chandler and N. W. Currie. It is located at the wagon bridge about one-half mile from Yosemite, Cal. The gage is a 1 by 6 inch vertical timber, painted white, and graduated to feet and tenths. It is securely fastened to an alder tree on the right bank 50 feet above bridge. Discharge measurements are made from lower side of bridge. The distance across the stream is marked by nails in bridge stringer every 5 feet. The initial point for soundings is stream face of abutment on right bank. The channel is straight for 50 feet above and 100 feet below station; both banks are above high water. The bed of the stream is composed of small granite fragments and is permanent. The bench mark is head of two nails driven in an alder tree, to which gage is fastened. Its elevation is 9.40 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Yosemite Creek at Yosemite Valley, California, in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
July 9	A. E. Chandler	4.85	70
July 19	N. W. Currie	4.49	33

Mean daily gage height, in feet, of Yosemite Creek at Yosemite Valley, California, for 1904.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	4.30	3.80	17	4.40	3.90	3.75
2	.....	4.70	3.80	18	4.40	3.90	3.80
3	.....	4.30	3.80	19	4.50	3.90	3.75
4	.....	4.30	3.80	20	4.45	3.90	3.75
5	.....	4.15	3.75	21	4.40	3.85	3.75
6	.....	4.18	3.75	22	4.40	3.80	3.75
7	.....	.....	3.75	23	4.38	3.85	3.85
8	.....	4.00	3.75	24	4.38	3.84	4.60
9	.....	4.00	3.75	25	4.30	3.85	.....
10	.....	3.95	3.75	26	4.20	3.80	.....
11	4.60	3.90	3.75	27	4.05	3.80	.....
12	4.70	3.90	3.75	28	4.10	3.80	.....
13	4.70	3.90	3.75	29	4.00	3.80	.....
14	4.55	3.90	3.75	30	4.00	3.80	.....
15	4.50	4.00	3.75	31	4.00	3.80	.....
16	4.50	4.05	3.80				

MISCELLANEOUS MEASUREMENTS IN SAN FRANCISCO BAY DRAINAGE BASIN.

The following miscellaneous measurements were made in the San Francisco Bay drainage basin in 1903 and 1904:

Miscellaneous measurements in San Francisco Bay drainage basin.

ALAMEDA CREEK DRAINAGE.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1904.				*Sec.-feet.*
May 27	S. G. Bennett	Arroyo Hondo	Near Sunol	18
May 27	do	Alameda Creek	At Niles dam	25

SACRAMENTO RIVER DRAINAGE.

1904.				
Aug. 9	W. B. Clapp	Upper Sacramento River.	Bards Station, Shasta County.	429
Aug. 11	do	Battle Creek	Near Balls Ferry, Tehama County.	423
Aug. 12	do	Stanford canal	Headworks near Vina, Cal.	58

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

SACRAMENTO RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1904.				*Sec-feet.*
Aug. 12	W. B. Clapp	Deer Creek	Near Vina, below heading of Stanford Canal.	69
		Total Deer Creek		127
Aug. 12	do	Mill Creek	Near Tehama, above all diversions.	160
Aug. 13	do	Antelope Creek	Near Red Bluff, above all diversions.	53

PIT RIVER DRAINAGE.

1904.				
Apr. 5	J. S. Evans	Ash Creek	Ash Valley	194
May 5	do	do	do	189
June 4	do	do	do	30
June 10	S. G. Bennett and J. S. Evans.	do	do	27
Sept. 17	J. Y. Toler	Dukes ditch	Near Likely	3.3
Sept. 23	do	do	do	8.7
Sept. 17	do	Corporation ditch	do	30
Aug. 16	S. G. Bennett and J. Y. Toler.	Davis Creek	Near Davis Creek P. O.	2.4
Jan. 7	J. S. Evans	Pit River	At county bridge, Alturas.	81
Aug. 27	J. Y. Toler	E. Lauer's ditch	Near Alturas	1.4
Aug. 27	do	M. Hugh's ditch	do	3
June 12	S. G. Bennett and J. S. Evans.	Rush Creek	At Round Valley	12
Aug. 30	J. Y. Toler	do	do	7.6
Aug. 26	do	Pine Creek	Near Pine Creek P. O.	7
Sept. 5	do	do	do	22
Sept. 14	do	Canyon Creek	Near Centerville	3.8
Sept. 15	do	Fitzhugh Creek	Near Alturas	2.7
Aug. 29	do	Willow Creek	Near Adin	5.6
Sept. 20	do	do	do	5
1903.				
Sept. 11	H. G. Heisler	Pit River	At Pitville	30

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

PIT RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
Sept. 11	H. G. Heisler	Fall River	At bridge near Fallriver Mills.	1,510
Sept. 10	do	Hat Creek	At Carbon Bridge	657
Sept. 9	do	Pit River	At Peck's bridge, above mouth of Burney Creek.	2,617
Sept. 9	do	Burney Creek	Below Burney Falls	210
Sept. 8	do	Hatchet Creek	Near Montgomery	10
Sept. 7	do	Montgomery Creek	At Montgomery	18

AMERICAN RIVER DRAINAGE.

1904.				
Jan. 6	S. G. Bennett	North Fork ditch	2½ miles above Folsom	32
1903.				
May 12	S. G. Bennett	Folsom canal	500 feet below heading	1,466
1904.				
Sept. 12	W. B. Clapp	South Fork	At Morman Island bridge, 4 miles above Folsom.	82
Sept. 14	do	North Fork	500 feet above junction with Middle Fork, near Auburn.	69
Sept. 14	do	Middle Fork	½ mile above Auburn bridge.	130

STANISLAUS RIVER DRAINAGE.

1903.				
Nov. 25	S. G. Bennett	Stanislaus Water Co.'s ditch.	Above penstock to power house, Knights Ferry.	85
Sept. 23	do	do	100 feet below penstock to power house, Knights Ferry.	61
Nov. 25	do	do	do	41
1904.				
Aug. 24	O. W. Peterson	Schell ditch	Near head, Knights Ferry.	7.4

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

TUOLUMNE RIVER DRAINAGE.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
Sept. 20	S. G. Bennett	Clavey River	Above mouth of Twomile Creek, Carter-Lake Eleanor trail.	2.6
Sept. 20	do	Twomile Creek	At mouth	.8
Sept. 20	do	Hull Creek	At Carter-Lake Eleanor trail crossing.	3.7
Sept. 21	do	North Fork of Tuolumne River.	Above mouth of Basin Slope Creek.	2.9
Sept. 19	do	Reed Creek	At Rosasco ranch	2.6
Sept. 19	do	Cherry River	Carter-Lake Eleanor trail crossing.	[a].6
Sept. 19	do	Eleanor Creek	One-half mile below Lake Eleanor.	1.0
Sept. 18	do	Tuolumne River	Above mouth, Hetch Hetchy Valley.	19.0
Sept. 18	do	Rancheria Creek	At mouth, Hetch Hetchy Valley.	1.3
Sept. 17	do	Tiltill Creek	Hetch Hetchy Valley	.2
Sept. 18	do	Tuolumne River	Lower end of Hetch Hetchy Valley.	23
Sept. 17	do	Middle Fork of Tuolumne River.	Six miles from Sequoia post-office.	.8
Sept. 17	do	South Fork of Tuolumne River.	One mile above Sequoia post-office.	7.7
1904.				
June 8	O. W. Peterson	Mining ditch	Near Lagrange dam	8.5
Aug. 22	do	do	do	3.7

MERCED RIVER DRAINAGE.

1903.				
June 25	S. G. Bennett	Tenaya Creek	At Tassaack Avenue Bridge, Yosemite Valley.	159
Sept. 15	do	do	do	3.0
June 25	do	Illilouette Creek	Near mouth of Yosemite Valley.	228
Sept. 15	do	do	do	3.9
June 24	do	Merced River	At bridge near Yosemite Valley post-office.	1,135
Sept. 15	do	do	do	27
June 24	do	Yosemite Creek	At wagon bridge below falls.	119

[a] Estimated.

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

MERCED RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
Sept. 15	S. G. Bennett	Yosemite Creek	At wagon bridge below falls.	[a] 2
June 25	do	Bridal Veil Creek	At Yosemite road bridge.	[a] 20
Sept. 15	do	do	do	[a] 2
Sept. 13	do	Alder Creek	South Fork Merced	1.0
Sept. 12	do	South Fork Merced River.	1,000 feet below Wawona Bridge.	1.5
Sept. 12	do	Washburn ditch	South Fork Merced	1.9
Sept. 11	do	Big Creek	At Summerdale	3.2
Sept. 11	do	Sugar Pine ditch	South Fork Merced	2.3

SAN JOAQUIN RIVER DRAINAGE.

1903.				
Sept. 11	S. G. Bennett	Soqual ditch	At site of old mill of Madera Flume and Trading Co.	[b] 3.8
Sept. 9	do	Chiquita San Joaquin	At mouth	10
Sept. 9	do	San Joaquin River	Below mouth Chiquita San Joaquin.	264

KING RIVER DRAINAGE.

1903.				
Sept. 3	S. G. Bennett	King River	One-half mile below mouth of North Fork.	332
Sept. 3	do	North Fork of King River.	At mouth	32
1904.				
May 13	S. G. Bennett and I. Teilman.	Gould canal	At Holland flume, ½ mile below head-gate.	260
May 13	S. G. Bennett	Church ditch	Near Kingriver post-office.	1,040
May 13	S. G. Bennett and I. Teilman.	Fowler Switch canal	200 feet below road bridge, near Kingriver post-office.	476
May 14	S. G. Bennett	do	do	588
May 13	do	Centerville and Kingsburg canal.	200 feet below Trimmer Spring road bridge, near Kingriver post-office.	727

[a] Estimated.
[b] Total flow of North Fork of San Joaquin River at this point.

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

KING RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
May 14	S. G. Bennett	'76 canal	At bridge near Carmelita.	676
May 17	do	Peoples ditch	300 feet below headgate near Kingsburg.	483
May 14	S. G. Bennett and I. Teilman.	Emigrant ditch	Near headworks, 3 miles from Kingsburg.	114
May 17	S. G. Bennett	Last Chance ditch	Near Laton	297
May 17	do	La Gunada de Tacahe grant canal.	At Laton	227
May 16	do	Liberty canal	At Lemoore road bridge crossing.	55
May 17	do	Lower King River canal.	Near Grangeville	180
May 16	do	Heinlen cut	50 feet above regulating weir.	1,298
May 16	S. G. Bennett and I. Teilman.	Zelda canal slough	1,500 feet below Lemoore road.	5,420
May 20	S. G. Bennett	Mill race ditch	Near head	20
May 19	do	Riverdale canal	do	[a] 1
May 19	do	Burrell ditch	do	42
May 19	do	Waste from New Riverdale ditch.	Into lower King River.	45
		Total New Riverdale canal.	Above waste	88
May 19	do	Turner ditch	Near head	8
May 19	do	Reed ditch	do	28
May 19	do	Crescent canal	Near Wheatville	38
May 19	do	Stimson canal	At Elkhorn road bridge crossing.	175

KAWEAH RIVER DRAINAGE.

1903.				
Aug. 31	S. G. Bennett	Stony Creek	North Fork Kaweah trail crossing.	1.2
Aug. 31	do	Dorst Creek	At North Fork Kaweah trail crossing.	2.6
Aug. 28	do	North Fork Kaweah	3 miles above Three Rivers.	7.3
1904.				
Sept. 20	F. R. S. Buttemer.	North Fork Kaweah River.	300 feet above intake of Schreibers ditch.	6.0

[a] Waste; water shut off.

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

KAWEAH RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
Aug. 30	S. G. Bennett	Marble Fork Kaweah River.	At bridge, Sequoia Park.	8.7
1904.				
Sept. 19	F. R. S. Buttemer.	Marble Fork Keweah River.	At bridge, Sequoia Park.	4.7
1903.				
Aug. 26	S. G. Bennett	East Fork Kaweah River.	At Mineral King	5.3
Aug. 26	do	do	Above headworks of Mount Whitney Power Co.'s canal.	23
1904.				
Sept. 16	F. R. S. Buttemer.	East Fork Kaweah River.	Above headworks of Mount Whitney Power Co.'s canal.	34
Sept. 22	do	Middle Fork Kaweah River.	800 feet above intake, Mount Whitney Power Co.'s canal.	27
Sept. 15	do	South Fork Kaweah River.	Above intake Cahoon's ditch, 9½ miles above junction with Middle Fork.	7.1
Sept. 18	do	Middle Fork Kaweah River.	200 feet above junction with Marble Fork.	23

TULE RIVER DRAINAGE.

1903.				
June 9	R. S. Hawley	South Fork Tule River	Near mouth	35
1904.				
Feb. 2	F. W. Huber	South Fork Tule River	Near mouth	7

KERN RIVER DRAINAGE.

1903.				
Aug. 24	S. G. Bennett	Little Kern River	3 miles below mouth of Shotgun Creek.	5.3
Aug. 22	do	do	Above junction with Kern River.	25
Aug. 22	do	North Fork Kern River.	Above junction with Little Kern River.	278
Aug. 21	do	Soda Creek	3 miles above mouth	2.4
Aug. 21	do	Nameless Creek		2.4
Aug. 20	do	Clark Creek		2.9

Miscellaneous measurements in San Francisco Bay drainage basin—Continued.

KERN RIVER DRAINAGE—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
Aug. 20	S. G. Bennett	Jackson Creek		2.8
Aug. 20	do	Wade Creek		2.6
Aug. 19	do	Tobias Creek	At mouth	1.9
Aug. 19	do	Salmon Creek	do	1.8
Aug. 18	do	Bull Run Creek	Above mouth	.8
Aug. 17	do	Peterson ditch	Near head, above Kernville.	1.5
Aug. 17	do	Thurston ditch	do	1.9
Aug. 17	do	North Fork of Kern River.	3 miles above Kernville.	277
Aug. 17	do	Big Blue ditch	At mill above Kernville.	25
Aug. 17	do	Neal & Stavert's upper ditch.	Above Kernville	2.2
Aug. 15	do	Brown's upper ditch		15.3
Aug. 15	do	Brown's ranch ditch		14.5
Aug. 15	do	Kernville town ditch		0.7
Aug. 15	do	Cook's ditch	Kernville	0.6
Aug. 17	do	Hooper Mill ditch	Near Isabella	8.9
Aug. 17	do	South Fork of Kern River.	Above mouth near Isabella.	17
Aug. 17	do	Kern River	Below mouth of South Fork, near Isabella.	254

NORTHERN PACIFIC OCEAN DRAINAGE BASIN.

LOST RIVER AT CLEAR LAKE, CAL.

Discharge measurements of Lost River at Clear Lake, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 7	T. H. Humphreys	4.95	10.78
September 25	C. T. Darley	5.20	16.00
October 21	F. S. Chapman	5.15	14.00
November 6	C. T. Darley	5.15	17.60
December 9	do	5.18	14.00

Mean daily gage height, in feet, of Lost River at Clear Lake, Cal., for 1904.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	5.25	5.20	5.20	17	5.00	5.25	5.20	.....
2	.....	5.25	5.20	5.20	18	5.00	5.25	5.20	.....
3	.....	5.25	5.15	.....	19	5.00	5.20	.....	.....
4	5.00	5.25	5.10	.....	20	5.00	5.20	.....	5.30
5	5.00	5.25	.....	.....	21	5.00	5.15	.....	5.15
6	5.00	5.25	.....	5.20	22	5.05	5.15	.....	5.20
7	5.00	5.25	.....	5.20	23	5.10	.....	5.20	5.20
8	5.00	5.25	5.15	5.15	24	5.10	.....	5.20	.....
9	5.00	5.25	5.15	5.15	25	5.20	5.10	5.20	.....
10	5.00	5.30	5.15	.....	26	5.25	5.10	5.20	.....
11	5.00	5.30	5.15	.....	27	5.25	5.10	.....	.....
12	5.00	5.30	.....	.....	28	5.25	5.10	5.20	.....
13	5.00	5.30	.....	5.20	29	5.25	.....	5.20	.....
14	5.00	5.30	.....	5.25	30	5.25	.....	.....	.....
15	5.00	5.30	5.15	5.30	31	.....	.....	.....	.....
16	5.00	5.30	5.20	5.30					

MILLER CREEK NEAR LORELLA, OREG.

Discharge measurements of Miller Creek at Horsefly, near Lorella, Oreg., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 24	T. H. Humphreys	.....	[a] 15.00
July 7	do	.....	[a] 12.00
August 4	do	.....	[a] 5.00
August 23	do	.....	[a] 1.00
September 27	do	6.10	1.71
October 16	C. T. Darley	6.20	4.09
November 19	do	6.25	7.26

[a] Estimated.

Mean daily gage height, in feet, of Miller Creek at Horsefly, near Lorella, Oreg., for 1904.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.00	6.10	6.10	6.20	17	6.10	.....	6.20	6.10	.....
2	.....	6.00	6.10	6.20	6.20	18	6.10	.....	6.20	6.30	.....
3	.....	6.00	6.10	6.20	6.15	19	6.10	.....	6.10	6.20	.....
4	.....	6.00	6.10	6.20	6.10	20	6.10	.....	6.10	6.20	.....
5	.....	6.00	6.10	6.20	6.10	21	6.10	.....	6.10	6.20	.....
6	.....	6.00	6.10	6.20	6.10	22	6.10	.....	6.10	6.20	.....
7	6.10	6.00	6.10	6.20	6.10	23	6.05	.....	6.10	6.20	.....
8	6.10	6.00	6.10	6.20	6.10	24	6.05	.....	6.10	6.20	.....
9	6.10	6.00	6.15	6.20	6.10	25	6.05	.....	6.10	6.20	.....
10	6.10	6.00	6.15	6.15	6.10	26	6.70	.....	6.10	6.20	.....
11	6.10	.....	6.30	6.15	.....	27	6.70	6.10	6.10	6.20	.....
12	6.10	.....	6.30	6.15	.....	28	6.00	6.10	6.10	6.20	.....
13	6.10	.....	6.20	6.15	.....	29	6.00	6.10	6.10	6.20	.....
14	6.10	.....	6.15	6.15	.....	30	6.00	6.10	6.10	6.20	.....
15	6.10	.....	6.20	6.11	.....	31	6.00	.....	6.10	.....	.....
16	6.10	.....	6.20	6.11	.....						

LOST RIVER AT MERRILL, OREG.

Discharge measurements of Lost River at Merrill, Oreg., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
September 6	T. H. Humphreys	3.55	159
September 26	C. T. Darley	3.50	163
October 20	T. H. Humphreys	3.50	145
November 5	C. T. Darley	3.40	147
November 27	do	3.48	158
December 17	do	3.45	147

Mean daily gage height, in feet, of Lost River at Merrill, Oreg., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.70	3.60	3.55	3.50	3.50	17	.....	3.70	3.55	3.55	3.50	3.50
2	.....	3.70	3.60	3.55	3.50	3.50	18	.....	3.70	3.55	3.55	3.50	3.50
3	.....	3.70	3.60	3.55	3.50	3.50	19	.....	3.70	3.55	3.50	3.50	3.50
4	.....	3.70	3.60	3.55	3.50	3.50	20	.....	3.70	3.55	3.50	3.50	3.50
5	.....	3.70	3.60	3.55	3.50	3.50	21	.....	3.70	3.55	3.50	3.50	3.50
6	.....	3.70	3.55	3.55	3.50	3.50	22	.....	3.70	3.55	3.50	3.50	3.50
7	.....	3.70	3.55	3.55	3.50	3.50	23	.....	3.70	3.55	3.50	3.50	3.50
8	.....	3.70	3.55	3.55	3.50	3.50	24	.....	3.70	3.55	3.50	3.50	3.50
9	.....	3.70	3.55	3.55	3.50	3.50	25	.....	3.70	3.55	3.50	3.50	.....
10	.....	3.70	3.55	3.55	3.50	3.50	26	3.70	3.70	3.55	3.50	3.50	.....
11	.....	3.70	3.55	3.55	3.50	3.50	27	3.70	3.60	3.55	3.50	3.50	.....
12	.....	3.70	3.55	3.55	3.50	3.50	28	3.70	3.60	3.55	3.50	3.50	.....
13	.....	3.70	3.55	3.55	3.50	3.50	29	3.70	3.60	3.55	3.50	3.50	.....
14	.....	3.70	3.55	3.55	3.50	3.50	30	3.70	3.60	3.55	3.50	3.50	.....
15	.....	3.70	3.55	3.55	3.50	3.50	31	3.70	3.60	.....	3.50	.....	.....
16	.....	3.70	3.55	3.55	3.50	3.50							

KLAMATH RIVER AT KENO, OREG.

Discharge measurements of Klamath River at Keno, Oreg., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 31	J. H. Lewis and Ivan Landis	15.15	8,321
June 5	do	15.05	8,230
June 18	T. H. Humphreys	14.65	7,205
August 12	do	13.00	2,571
September 17	do	12.40	1,791
September 28	C. T. Darley	12.40	1,721
October 19	do	12.50	1,900
November 3	do	12.60	1,938
November 26	do	12.65	2,161

Mean daily gage height, in feet, of Klamath River at Keno, Oreg., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	15.10	14.20	13.30	12.70	12.40	12.60	12.70
2	.....	15.10	14.10	13.30	12.60	12.40	12.60	12.70
3	.....	15.10	14.10	13.30	12.60	12.40	12.60	12.70
4	.....	15.05	14.10	13.20	12.60	12.40	12.60	12.70
5	.....	15.00	14.05	13.20	12.60	12.40	12.60	12.70
6	.....	15.00	14.00	13.20	12.60	12.40	12.60	12.70
7	.....	15.00	14.00	13.10	12.50	12.40	12.60	12.70
8	.....	14.90	14.00	13.10	12.50	12.40	12.60	12.70
9	.....	14.90	14.00	13.10	12.50	12.50	12.60	12.70
10	.....	14.90	13.90	13.00	12.50	12.50	12.60	12.80
11	.....	14.90	13.90	13.00	12.50	12.50	12.60	12.80
12	.....	14.90	13.90	13.00	12.40	12.40	12.60	12.80
13	.....	14.80	13.80	13.00	12.40	12.40	12.60	12.80
14	.....	14.80	13.80	13.00	12.40	12.40	12.60	12.80
15	.....	14.80	13.80	13.00	12.40	12.40	12.60	12.80
16	.....	14.80	13.80	13.00	12.40	12.40	12.60	12.80
17	.....	14.70	13.80	12.90	12.40	12.50	12.60	12.80
18	.....	14.70	13.80	12.90	12.40	12.50	12.60	12.80
19	.....	14.60	13.70	12.90	12.40	12.50	12.60	12.80
20	.....	14.60	13.70	12.90	12.40	12.50	12.60	12.80
21	.....	14.60	13.70	12.90	12.40	12.50	12.70	12.80
22	.....	14.60	13.60	12.80	12.40	12.50	12.70	12.80
23	.....	14.50	13.60	12.80	12.40	12.50	12.70	12.80
24	.....	14.50	13.60	12.80	12.40	12.50	12.70	12.80
25	.....	14.40	13.50	12.80	12.40	12.50	12.70	.....
26	.....	14.40	13.50	12.80	12.40	12.50	12.70	.....
27	.....	14.40	13.50	12.70	12.40	12.50	12.70	.....
28	.....	14.30	13.40	12.70	12.40	12.50	12.70	.....
29	.....	14.30	13.40	12.70	12.40	12.50	12.70	.....
30	.....	14.20	13.40	12.70	12.40	12.50	12.70	.....
31	15.10	.....	13.40	12.70	.....	12.50	.....	.....

KLAMATH RIVER AT KLAMATH FALLS, OREG.

Discharge measurements of Klamath River at Klamath Falls, Oreg., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
May 15	J. H. Lewis and Ivan Landis	7.15	9,073
June 7	do	6.55	7,342
August 25	T. H. Humphreys	3.70	1,915
September 16	C. T. Darley	3.40	1,782
September 28	do	3.30	2,005
October 18	do	3.40	2,135
November 8	do	3.50	1,968
November 24	do	3.60	1,898

Mean daily gage height, in feet, of Klamath River at Klamath Falls, Oreg., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.75	5.50	4.35	3.50	3.30	3.50	3.55
2	.....	6.80	5.45	4.30	3.50	3.30	3.45	3.60
3	.....	6.70	5.40	4.25	3.50	3.30	3.45	3.60
4	.....	6.70	5.40	4.20	3.45	3.30	3.45	3.60
5	.....	6.65	5.35	4.20	3.45	3.30	3.45	3.65
6	.....	6.60	5.30	4.15	3.45	3.30	3.50	3.70
7	.....	6.55	5.30	4.15	3.45	3.30	3.50	3.70
8	.....	6.55	5.25	4.15	3.45	3.35	3.50	3.70
9	.....	6.50	5.25	4.10	3.40	3.40	3.50	3.70
10	.....	6.45	5.20	4.05	3.40	3.40	3.50	3.70
11	.....	6.40	5.20	4.05	3.40	3.40	3.55	3.70
12	.....	6.40	5.15	4.00	3.40	3.35	3.55	3.70
13	.....	6.35	5.10	4.00	3.35	3.35	3.60	3.75
14	.....	6.30	5.10	3.95	3.35	3.40	3.50	3.75
15	7.15	6.30	5.05	3.95	3.35	3.40	3.50	3.80
16	7.10	6.25	5.00	3.90	3.35	3.45	3.50	3.80
17	7.10	6.20	4.95	3.85	3.35	3.40	3.50	3.80
18	7.15	6.10	4.90	3.85	3.30	3.40	3.50	3.80
19	7.10	6.05	4.85	3.80	3.30	3.45	3.55	3.80
20	7.10	6.00	4.80	3.80	3.30	3.45	3.50	3.80
21	7.10	6.00	4.80	3.75	3.30	3.45	3.50	3.80
22	7.05	5.95	4.75	3.75	3.45	3.45	3.55	3.85
23	7.00	5.85	4.75	3.70	3.40	3.45	3.55	3.90
24	7.00	5.80	4.75	3.70	3.35	3.45	3.60	3.95
25	6.95	5.75	4.70	3.70	3.30	3.45	3.60	.....
26	6.90	5.75	4.65	3.65	3.30	3.45	3.60	.....
27	6.90	5.70	4.60	3.65	3.25	3.45	3.60	.....
28	6.90	5.65	4.55	3.60	3.30	3.45	3.60	.....
29	6.85	5.60	4.50	3.55	3.20	3.45	3.60	.....
30	6.85	5.55	4.45	3.55	3.20	3.45	3.65	.....
31	6.80	.....	4.40	3.55	.....	3.45	.....	.....

SPRAGUE RIVER AT YAINAX, OREG.

Mean daily gage height, in feet, of Sprague River at Yainax, Oreg., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	18.80	14.11	14.60	14.20	13.11	13.80	14.50
2	18.80	14.11	14.50	14.20	13.11	13.80	14.50
3	18.70	14.11	14.80	14.20	13.11	13.90	14.60
4	18.70	14.10	14.80	.....	13.11	13.90	14.60
5	18.70	14.10	14.70	.....	14.00	13.90	14.60
6	18.60	14.90	14.70	.....	14.10	13.90	14.50
7	18.60	14.80	14.80	.....	14.00	13.90	14.50
8	18.50	14.80	14.80	.....	14.10	13.10	14.50
9	18.50	14.70	14.80	.....	14.10	13.10	14.50
10	18.40	14.70	14.70	.....	14.20	13.10	14.60
11	18.30	14.60	14.70	.....	14.30	13.11	14.60
12	18.20	14.50	14.70	.....	14.10	13.11	14.60
13	18.10	14.50	14.60	.....	14.10	13.11	14.60
14	17.70	14.40	14.60	.....	14.00	14.00	14.70
15	17.60	14.40	14.50	.....	14.00	14.00	14.70
16	17.40	14.30	14.50	.....	14.00	14.10	14.70
17	17.40	14.30	14.50	.....	14.00	14.20	14.80
18	17.30	14.30	14.50	.....	14.00	14.20	14.80
19	17.20	14.60	14.50	.....	13.11	14.20	14.70
20	17.10	14.60	14.50	.....	13.10	14.20	14.70
21	16.11	14.80	14.50	.....	13.10	14.20	14.60
22	16.10	14.80	14.50	.....	13.10	14.40	14.60
23	16.10	14.80	14.40	.....	13.90	14.40	14.50
24	16.90	14.70	14.40	.....	13.90	14.30	14.50
25	16.80	14.60	14.40	.....	13.90	14.30	.....
26	16.70	14.50	14.40	.....	13.80	14.30	.....
27	16.60	14.50	14.40	.....	13.80	14.40	.....
28	16.40	14.40	14.40	.....	13.80	14.40	.....
29	16.20	14.40	14.30	.....	13.70	14.50	.....
30	15.00	14.50	14.30	.....	13.70	14.50	.....
31	.....	14.50	14.30	.....	13.80	.....	.....

UPPER KLAMATH LAKE NEAR PELICAN, OREG.

Mean daily gage height, in feet, of Upper Klamath Lake near Pelican, Oreg., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	5.70	4.50	3.85	3.40	3.40	17	.....	5.10	4.15	3.50	3.40	3.35
2	.....	5.65	4.55	3.85	3.35	3.35	18	.....	5.05	4.20	3.55	3.35	3.30
3	.....	5.65	4.50	3.85	3.40	3.35	19	.....	5.00	4.10	3.50	3.35	3.40
4	.....	5.60	4.50	3.75	3.40	3.30	20	.....	4.95	4.10	3.45	3.50	3.45
5	.....	5.60	4.45	3.75	3.40	3.30	21	.....	4.90	4.05	3.45	3.40	3.50
6	.....	5.55	4.55	3.80	3.35	3.25	22	.....	4.85	4.05	3.45	3.50	3.45
7	.....	5.50	4.45	3.85	3.40	3.30	23	.....	4.80	4.05	3.40	3.60	.....
8	.....	5.50	4.30	3.85	3.40	3.30	24	.....	4.75	4.00	3.40	3.60	.....
9	.....	5.45	4.35	3.85	3.40	3.40	25	.....	4.70	4.05	3.40	3.55	.....
10	.....	5.40	4.40	3.70	3.30	3.45	26	.....	4.70	3.95	3.45	3.50	.....
11	.....	5.35	4.20	3.65	3.35	3.50	27	.....	4.70	3.90	3.40	3.50	.....
12	.....	5.30	4.30	3.70	3.40	3.45	28	5.80	4.65	3.95	3.35	3.45	.....
13	.....	5.25	4.35	3.75	3.35	3.40	29	5.80	4.60	3.95	3.40	3.50	.....
14	.....	5.20	4.30	3.70	3.35	3.35	30	5.75	4.60	3.85	3.40	3.40	.....
15	.....	5.20	4.20	3.75	3.35	3.30	31	5.70	.....	3.90	3.45	.....	.....
16	.....	5.15	4.20	3.65	3.40	3.30							

TULE LAKE NEAR MERRILL, OREG.

Mean daily gage height, in feet, of Tule Lake near Merrill, Oreg., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1								
2						8.80		
3								
4								8.50
5								
6								
7								
8								
9						8.80		
10		10.40						
11					9.00			
12								
13								
14								
15				9.40			8.65	
16			10.10					
17	10.50							
18					8.90			
19								
20								
21								
22				9.25				
23								
24								
25								
26								
27								
28								
29	10.70							
30								
31				9.10				

MISCELLANEOUS MEASUREMENTS IN KLAMATH RIVER DRAINAGE BASIN.

[By T. H. Humphreys, J. H. Lewis, and C. T. Darley.]

Miscellaneous measurements in Klamath River drainage basin.

Date.	Gage height.	Stream.	Location.	Discharge.
1903.	*Feet.*			*Sec.-feet.*
October 24[a]		Klamath River	Klamathon	2,000
1904.				
June 14		Antelope Creek	At head	[b] 155
June 13		Butte Creek	¼ mile above Wm. Bray's house, Cal.	148
June 15		do	1 mile above Boyce ranch, Cal.	124

[a] Measurement made by H. E. Green.

[b] Estimated.

Miscellaneous measurements in Klamath River drainage basin—Continued.

Date.	Gage height.	Stream.	Location.	Discharge.
1904.	*Feet.*			*Sec.-feet.*
June 8		Little Shasta	Table Rock, Cal	117
June 8		Ankney canal	Klamath Falls, Oreg	32
August 15		do	do	48
August 15		do	7 miles below intake, Klamath Falls, Oreg.	37
August 15		do	Klamath Falls, Oreg	40
August 27		do	do	43
August 27		do	do	29
August 27		do	7 miles below intake, Klamath Falls, Oreg.	33
August 27		Lateral of Ankney canal.	Klamath Falls, Oreg	4.8
May 20		Miller Creek	Lorella, Oreg	326
October 2		Adams ditch	Merrill, Oreg	26
May 23	5.8	Lost River	Olene, Oreg	961
June 10	4.9	do	do	322
May 19	8.9	do	Langells Valley, Oreg	746
May 21	12.4	Sprague River	10 miles above Yainax, Oreg.	2,075
June 12	10.9	do	do	1,081
May 25		Williamson River	Bridge near junction with Sprague River, Oreg.	2,091
May 26		Wood River	Fort Klamath, Oreg	450
May 22	9.3	Sprague River	5 miles below Yainax, Oreg.	3,915

MISCELLANEOUS MEASUREMENTS IN NORTHERN PACIFIC OCEAN DRAINAGE BASIN.[a]

Miscellaneous measurements in Northern Pacific Ocean drainage basin.

MAD RIVER DRAINAGE.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
Oct. 20	S. G. Bennett	Mad River	Vance, Cal	53

[a] In this system are included streams which drain directly into the Pacific Ocean.

Miscellaneous measurements in Northern Pacific Ocean drainage basin—Continued.

EEL RIVER DRAINAGE.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
Oct. 21	S. G. Bennett	Eel River	Stingleys station	189

RUSSIAN RIVER DRAINAGE.

1903.				
Jan. 22	S. G. Bennett	Russian River	Healdsburg	628

PAJARO RIVER DRAINAGE.

1904.				
Dec. 13	W. B. Clapp Geo. Senger	San Benito River	Kehlo ranch, 7 miles above Hollister.	1.6

THE GREAT BASIN DRAINAGE.

Under this head is comprised a limited area of arid country in California lying on the eastern slope of the Sierra Nevadas. These areas include the Susan and Owens river drainage basins. Having no outlet to the sea, the entire drainage of these basins is lost mainly through evaporation from the lakes and sinks in which the waters of these rivers collect.

Susan River has its source in the Sierra Nevada in northeastern California, and flows eastward, discharging into Honey Lake—one of the landlocked lakes of the Great Basin—of which it is the principal feeder. A considerable area of land is irrigated from the waters of the river below the gaging station, and during the last ten or twelve years several projects have been started for irrigating other extensive areas by the storage of its waters both above and below the town of Susanville.

Owens River has its source in the Sierra Nevada in eastern California, and flowing southerly parallel with this range its discharge is gradually increased by numerous tributaries until it finally discharges into Owens Lake. A considerable area of land is irrigated from the waters of the river and tributaries. Numerous gaging stations are maintained on the river, canals, and creek, and during the last two years extensive investigations have been made by the Reclamation Service of the United States Geological Survey for the construction of storage reservoirs and an irrigation system.

The following pages give the results of data collected at these stations during 1904:

SUSAN RIVER NEAR SUSANVILLE, CAL.

This station was established June 3, 1900, by L. H. Taylor, at which time a temporary gage was installed on the right bank. It is located about three-fourths of a mile southwest of Susanville, at the electric-light plant. A short distance above the station a small irrigating ditch, known as the "Masten ditch," is taken out on the right bank. There is a flume near its head in which a gage has been placed. On December 20, 1903, the station at the electric-light plant was reestablished by H. E. Green. A new gage was set which was made to read 2 feet more than original gage. A cable was installed for high-water measurements. The initial point for soundings is a post in the fence in line with the cable. The cable support on the left bank is 34.8 feet from the initial point for soundings. The channel is straight for 150 feet above and for 250 feet below the cable. The current is swift. There is a riffle immediately above the cable. The right bank is high and is composed of clay covered with vegetation. It is not liable to overflow. The left bank is low, liable to overflow, and is covered with a sparse growth of willows. The bed of the stream is composed of gravel and cobblestones and is permanent. Bench mark No. 1 is a nail in the fence post, which is used as the initial point for soundings. Its elevation is 11.35 feet above the zero of the gage. Bench mark No. 2 is a nail in the cable post. Its elevation is 9.00 feet above the zero of the gage. Bench mark No. 3 is a nail in the cottonwood tree to which the cable is attached. Its elevation is 10.00 feet above the zero of the gage. The gage is read once each day by James Branham.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Susan River near Susanville, Cal., in 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
February 21	James Branham	5.30	106
February 28	do	6.40	298
March 29	do	7.55	716
June 16	S. G. Bennett and J. S. Evans	5.60	180
June 29	James Branham	4.95	96
July 31	do	4.20	27
August 10	do	4.50	53
September 11	do	3.85	11
October 25	W. B. Clapp and J. Y. Toler	4.10	23

Mean daily gage height, in feet, of Susan River near Susanville, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.30	4.20	6.20	6.85	6.25	6.05	4.90	4.10	3.90	4.00	4.10	4.30
2	4.25	4.20	6.80	6.90	6.15	6.00	5.20	4.10	3.85	4.00	4.20	4.30
3	4.25	4.20	7.00	6.90	6.15	5.95	5.20	4.05	3.80	4.00	4.10	4.20
4	4.25	4.20	7.55	7.05	6.20	5.90	5.20	4.20	3.80	4.00	4.10	4.10
5	4.20	4.25	7.20	7.00	6.30	5.90	5.10	4.50	3.80	4.00	4.10	4.10
6	4.20	4.25	7.45	7.15	6.85	5.80	5.15	4.50	3.80	4.00	4.10	4.10
7	4.20	4.25	7.80	7.15	7.30	5.80	5.10	4.50	3.80	4.10	4.10	4.10
8	4.20	4.25	8.70	7.30	7.35	5.75	4.65	4.50	3.80	4.10	4.10	4.10
9	4.20	4.25	7.75	7.45	7.50	5.70	4.50	4.50	3.80	4.10	4.10	4.10
10	4.25	4.25	7.50	7.80	7.55	5.70	4.50	4.50	3.80	4.20	4.10	4.10
11	4.30	4.25	7.00	8.05	7.80	5.60	4.40	4.40	3.90	4.55	4.10	4.05
12	4.30	4.30	6.70	8.25	7.95	5.50	4.40	4.40	3.95	4.40	4.10	4.05
13	4.30	4.30	6.45	8.60	8.15	5.50	4.35	4.40	3.95	4.30	4.10	4.10
14	4.30	4.30	6.55	8.80	8.20	5.50	4.30	4.40	3.95	4.30	4.10	4.10
15	4.25	5.60	6.70	8.95	8.10	5.45	4.30	4.40	3.95	4.20	4.10	4.10
16	4.25	9.00	6.35	8.50	8.05	5.50	4.30	4.40	3.95	4.25	4.20	4.10
17	4.25	6.70	7.85	8.25	7.90	5.50	4.30	4.40	3.95	4.25	4.20	4.05
18	4.25	6.20	8.80	8.25	7.85	5.40	4.30	4.40	3.95	4.20	4.15	4.05
19	4.25	5.65	9.00	8.30	7.55	5.40	4.30	4.40	4.00	4.20	4.15	4.00
20	4.30	5.35	8.45	7.75	7.40	5.35	4.30	4.40	4.00	4.15	4.15	4.00
21	4.30	5.85	7.75	7.45	7.40	5.30	4.25	4.40	4.00	4.15	4.10	4.00
22	4.30	9.90	7.45	7.25	7.30	5.30	4.20	4.40	4.00	4.10	4.10	4.00
23	4.30	7.85	7.10	7.05	7.30	5.30	4.20	4.40	4.20	4.10	4.10	4.05
24	4.30	9.65	6.80	6.90	7.30	5.30	4.30	4.40	4.40	4.10	4.10	4.05
25	4.30	8.20	6.70	6.85	7.20	5.20	4.60	4.40	4.30	4.10	4.10	4.05
26	4.30	7.50	6.65	6.80	7.05	5.10	4.55	4.25	4.20	4.10	4.10	4.10
27	4.25	6.95	6.70	6.75	6.80	5.00	4.50	4.00	4.10	4.10	4.25	4.10
28	4.20	6.40	7.85	6.65	6.70	5.00	4.45	4.00	4.10	4.10	4.20	4.10
29	4.20	6.20	7.55	6.65	6.50	4.90	4.45	3.95	4.05	4.10	4.20	4.10
30	4.20	.....	7.30	6.25	6.40	4.90	4.40	3.90	4.05	4.10	4.20	7.60
31	4.20	.....	6.95	.....	6.25	.....	4.25	3.90	.....	4.10	.....	5.45

Estimated monthly discharge of Susan River near Susanville, Cal., 1904.

[Drainage area, 256 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	30	24	27	1,660	0.11	0.13
February	1,750	24	349	20,075	1.36	1.47
March	1,300	300	629	38,676	2.46	2.84
April	1,275	312	695	41,355	2.71	3.02
May	960	288	600	36,893	2.34	2.70
June	262	80	160	9,521	.62	.69
July	116	27	51	3,136	.20	.23
August	42	13	31	1,906	.12	.14
September	36	10	16	952	.06	.07
October	46	16	22	1,353	.09	.10
November	27	20	21	1,250	.08	.09
December	725	16	47	2,890	.18	.21
The year	1,750	10	221	159,667	.86	11.69

WILLOW CREEK AT MERRILLVILLE, CAL.

This station was established June 18, 1904, by S. G. Bennett. It is located at old bridge 100 feet above present wagon bridge. The gage is a 2 by 4 inch vertical rod fastened to the left end of the bridge. It is read once each day by R. W. Hurlbut. Discharge measurements are made from the bridge. The initial point for soundings is on the left bank of the stream. The distance across stream is marked on the foot bridge at intervals of 2 feet. The channel is straight above and below the bridge for a distance of 100 feet. The banks on each side are low, but not subject to overflow, as there is very little fluctuation in the discharge of the creek. The bed of the stream is composed of gravel and is not subject to much change.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Willow Creek at Merrillville, Cal., 1904.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Second-feet.*
June 18	S. G. Bennett	1.00	19.0
July 17	James Branham	.95	14.9
August 29	do	1.05	17.9
October 25	J. Y. Toler and W. B. Clapp	1.07	19.3

Mean daily gage height, in feet, of Willow Creek at Merrillville, Cal., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.00	1.00	1.00	1.05	1.10	1.10
2	1.00	1.00	1.10	1.05	1.10	1.10
3	1.00	1.05	1.10	1.05	1.10	1.05
4	1.00	1.00	1.05	1.05	1.10	1.05
5	1.00	1.00	1.05	1.05	1.10	1.05
6	1.05	1.00	1.05	1.10	1.05	1.05
7	1.00	.95	1.10	1.10	1.10	1.05
8	1.00	1.05	1.05	1.05	1.05	1.05
9	1.00	1.05	1.05	1.10	1.10	1.10
10	.95	1.00	1.10	1.10	1.10	1.05
11	1.10	1.00	1.05	1.05	1.10	1.05
12	1.15	1.00	1.00	1.05	1.10	1.05
13	1.20	1.00	1.00	1.05	1.10	1.10
14	1.10	1.00	1.05	1.10	1.10	1.10
15	1.10	1.00	1.05	1.20	1.10	1.05
16	1.10	1.00	1.05	1.10	1.10	1.05
17	1.00	1.05	1.05	1.05	1.05	1.05
18	1.00	1.00	1.05	1.05	1.10	1.05
19	1.00	1.00	1.00	1.05	1.10	1.05
20	1.00	1.00	1.00	1.05	1.10	1.05
21	1.05	1.00	1.05	1.05	1.10	1.05
22	1.00	1.00	1.05	1.05	1.10	1.05

Mean daily gage height, in feet, of Willow Creek at Merrillville, Cal., for 1904—Continued.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
23	1.00	1.00	1.10	1.05	1.05	1.10
24	1.00	1.00	1.10	1.05	1.05	1.10
25	1.00	1.05	1.10	1.05	1.05	1.05
26	1.00	1.00	1.05	1.05	1.05	1.00
27	1.00	1.00	1.05	1.10	1.10	1.05
28	1.00	1.00	1.05	1.05	1.10	1.05
29	1.05	1.00	1.05	1.10	1.10	1.20
30	1.00	1.05	1.00	1.10	1.10	1.70
31	1.00	1.00	.....	1.10	.....	1.20

Estimated monthly discharge of Willow Creek at Merrillville, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
July	22	17	19	1,168
August	19	17	18	1,107
September	20	18	19	1,131
October	22	19	19	1,168
November	20	19	20	1,190
December	50	19	20	1,230
The period	50	17	19	6,994

OWENS RIVER NEAR ROUND VALLEY, CAL.

This station was established by J. C. Clausen, assisted by R. S. Hawley, on August 3, 1903. It is located at the footbridge, 700 feet above the junction of Owens River and Rock Creek. The river at this point cuts through a lava deposit about 100 feet thick and forms a gorge which is about 250 feet wide at the top. The gage is a 1 by 4 inch vertical rod, fastened to the concrete bridge abutment on the left bank. It is read once each day by Roscoe Jones. Discharge measurements are made from the single-span footbridge to which the gage is attached. The bridge is 37 feet long and has a clear span of 35 feet. The initial point for soundings is the anchor bolt of the right abutment. The channel is straight for 175 feet above and for 250 feet below the station. The current is swift at all stages. Both banks are high and rocky and are not liable to overflow. The bed of the stream is composed of rock and lava bowlders and is not subject to much change. The bench mark is a bolt set in a lava bowlder 97.4 feet north of the right abutment.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, hydrographers.

Discharge measurements of Owens River near Round Valley, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 3	R. S. Hawley	1.80	161
August 9	do	1.85	160
August 18	do	1.75	159
August 22	do	1.75	160
September 1	do	1.74	159
September 12	do	1.80	175
October 8	do	1.85	185
October 25	do	1.82	173
November 24	do	1.88	196
December 29	do	1.70	151
1904.			
January 25	R. S. Hawley	1.80	184
March 2	do	2.20	270
March 28	do	2.85	458
April 8	E. C. Murphy, S. G. Bennett, and R. S. Hawley.	1.87	186
April 27	R. S. Hawley	1.82	190
June 2	do	2.57	383
June 15	do	3.10	564
July 13	J. C. Clausen and L. M. Barnes	2.55	380
August 3	L. M. Barnes	2.40	324
September 9	R. S. Hawley	2.01	232
October 13	R. S. Hawley, W. B. Clapp, and R. J. Taylor	2.25	269
November 12	R. J. Taylor	2.00	218
December 6	do	1.85	155

Mean daily gage height, in feet, of Owens River near Round Valley, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	.....	.....	.....	.....	.....	.....	.....	.....	1.75	1.77	1.80	1.80
2	.....	.....	.....	.....	.....	.....	.....	.....	1.75	1.80	1.80	1.80
3	.....	.....	.....	.....	.....	.....	.....	.....	1.75	1.80	1.80	1.80
4	.....	.....	.....	.....	.....	.....	.....	1.80	1.73	1.83	1.80	1.70
5	.....	.....	.....	.....	.....	.....	.....	1.80	1.70	1.80	1.80	1.70
6	.....	.....	.....	.....	.....	.....	.....	1.80	1.72	1.80	1.75	1.70
7	.....	.....	.....	.....	.....	.....	.....	1.80	1.73	1.80	1.70	1.70
8	.....	.....	.....	.....	.....	.....	.....	1.80	1.75	1.82	1.70	1.70
9	.....	.....	.....	.....	.....	.....	.....	1.85	1.77	1.80	1.70	1.70
10	.....	.....	.....	.....	.....	.....	.....	1.80	1.80	1.83	1.70	1.70
11	.....	.....	.....	.....	.....	.....	.....	1.80	1.80	1.80	1.70	1.70
12	.....	.....	.....	.....	.....	.....	.....	1.90	1.80	1.80	1.70	1.70
13	.....	.....	.....	.....	.....	.....	.....	1.90	1.80	1.80	1.70	1.70
14	.....	.....	.....	.....	.....	.....	.....	1.90	1.80	1.82	1.70	1.70
15	.....	.....	.....	.....	.....	.....	.....	1.80	1.80	1.80	1.70	1.70
16	.....	.....	.....	.....	.....	.....	.....	1.80	1.80	1.80	1.70	1.80
17	.....	.....	.....	.....	.....	.....	.....	1.80	1.70	1.80	1.70	1.80
18	.....	.....	.....	.....	.....	.....	.....	1.75	1.80	1.80	1.70	1.80
19	.....	.....	.....	.....	.....	.....	.....	1.75	1.80	1.80	1.70	1.80
20	.....	.....	.....	.....	.....	.....	.....	1.75	1.80	1.80	1.70	1.80
21	.....	.....	.....	.....	.....	.....	.....	1.68	1.80	1.80	1.70	1.80
22	.....	.....	.....	.....	.....	.....	.....	1.72	1.80	1.80	1.70	1.80
23	.....	.....	.....	.....	.....	.....	.....	1.80	1.80	1.80	1.80	1.80
24	.....	.....	.....	.....	.....	.....	.....	1.75	1.78	1.80	1.90	1.80
25	.....	.....	.....	.....	.....	.....	.....	1.80	1.77	1.80	1.90	1.80
26	.....	.....	.....	.....	.....	.....	.....	1.80	1.80	1.80	1.80	1.80
27	.....	.....	.....	.....	.....	.....	.....	1.78	1.80	1.80	1.80	1.70
28	.....	.....	.....	.....	.....	.....	.....	1.72	1.80	1.80	1.80	1.70
29	.....	.....	.....	.....	.....	.....	.....	1.70	1.80	1.80	1.80	1.70
30	.....	.....	.....	.....	.....	.....	.....	1.70	1.78	1.80	1.80	1.70
31	.....	.....	.....	.....	.....	.....	.....	1.70	.....	1.70	.....	1.70
1904.												
1	1.70	1.85	2.20	2.00	1.80	2.60	3.00	2.70	2.30	2.30	2.15	2.10
2	1.70	1.85	2.20	2.00	1.80	2.60	2.90	2.60	2.25	2.30	2.15	2.10
3	1.70	1.80	2.20	2.00	1.80	2.80	3.00	2.50	2.20	2.20	2.15	2.10
4	1.70	1.85	2.20	1.90	1.80	2.90	3.00	2.50	2.10	2.20	2.20	2.10
5	1.70	1.85	2.20	1.90	1.85	2.90	3.00	2.45	2.10	2.15	2.30	2.10
6	1.70	1.80	2.20	1.90	1.90	3.00	3.00	2.40	2.10	2.10	2.20	2.10
7	1.70	1.80	2.10	1.90	1.95	3.00	2.90	2.50	2.20	2.15	2.10	2.00
8	1.70	1.80	2.10	1.90	2.00	2.90	2.90	2.60	2.20	2.20	2.10	2.00
9	1.70	1.85	1.90	1.90	2.00	2.90	2.90	2.70	2.15	2.20	2.10	2.00
10	1.70	1.85	2.00	1.90	2.10	3.00	2.90	2.70	2.15	2.25	2.10	2.00
11	1.70	1.90	2.00	1.90	2.10	3.00	2.85	2.60	2.15	2.30	2.10	2.00
12	1.70	1.90	1.90	1.90	2.20	3.00	2.85	2.60	2.10	2.30	2.10	2.00
13	1.70	1.90	1.90	2.00	2.20	3.00	2.90	2.60	2.00	2.25	2.10	2.00
14	1.70	2.00	1.90	2.10	2.20	3.00	2.80	2.60	2.00	2.25	2.10	2.00
15	1.70	1.95	2.20	2.00	2.40	3.10	2.60	2.45	2.10	2.20	2.10	2.05
16	1.70	2.50	2.20	2.00	2.50	3.40	2.60	2.55	2.10	2.20	2.10	2.05
17	1.70	2.25	2.20	1.90	2.50	3.40	2.55	2.50	2.10	2.10	2.10	2.05
18	1.70	1.95	2.20	1.90	2.50	3.30	2.55	2.45	2.10	2.00	2.10	2.05
19	1.70	1.90	2.20	2.00	2.50	3.30	2.50	2.40	2.00	2.15	2.10	2.00
20	1.70	2.00	2.20	1.90	2.40	3.40	2.50	2.25	2.00	2.15	2.10	2.00
21	1.70	1.95	2.20	1.90	2.40	3.30	2.50	2.30	2.00	2.20	2.10	1.95
22	1.70	2.00	2.20	1.90	2.40	3.30	2.65	2.25	2.00	2.15	2.10	1.90
23	1.70	2.30	2.20	1.90	2.40	3.20	2.70	2.25	2.10	2.15	2.10	1.85
24	1.75	2.30	2.10	1.85	2.50	3.30	2.60	2.30	2.90	2.15	2.10	1.80
25	1.80	2.30	2.10	1.85	2.70	3.20	2.55	2.30	2.95	2.15	2.00	1.80
26	1.80	2.30	2.10	1.90	2.80	3.10	2.55	2.30	2.60	2.15	2.00	1.80
27	1.70	2.20	2.10	1.90	2.80	3.20	2.70	2.30	2.55	2.15	2.00	1.90
28	1.80	2.00	2.85	1.90	2.80	3.20	2.70	2.30	2.45	2.15	2.00	1.95
29	1.80	2.00	2.60	1.85	2.60	3.10	2.65	2.30	2.40	2.10	2.00	1.90
30	1.80	.....	2.00	1.80	2.60	3.10	2.70	2.30	2.40	2.10	2.00	2.00
31	1.85	.....	1.95	.....	2.55	.....	2.80	2.25	.....	2.10	.....	2.00

Rating table for Owens River near Round Valley, Cal., from August 4, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	132	2.20	272	2.70	412	3.20	568
1.70	152	2.30	298	2.80	442	3.30	601
1.80	172	2.40	325	2.90	473	3.40	636
1.90	196	2.50	353	3.00	504	3.50	675
2.00	221	2.60	382	3.10	536	3.60	715
2.10	246						

Estimated monthly discharge of Owens River near Round Valley, Cal., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
August 4–31	196	148	169	9,386
September	172	152	167	9,937
October	179	152	172	10,576
November	196	152	163	9,699
December	172	152	161	9,900
The period				49,498
1904.				
January	184	152	156.6	9,629
February	353	172	220.9	12,706
March	458	196	259.7	15,968
April	246	172	201.5	11,990
May	442	172	299.5	18,416
June	635	382	532	31,656
July	504	353	428	26,317
August	412	285	336	20,660
September	489	221	281	16,721
October	298	221	266	16,356
November	298	221	246	14,638
December	246	172	218	13,404
The year	635	152	287	208,461

ROCK CREEK NEAR ROUND VALLEY, CAL.

This station was established August 3, 1903, by J. C. Clausen and R. S. Hawley. It is located at the wagon bridge on the road from Long Valley to Bishop, 3,500 feet above the mouth of the creek. The gage is a 1 by 4 inch vertical rod fastened to the left end of the bridge. It is read once each day by Roscoe Jones. Discharge measurements are made from a footbridge which has a span of 18 feet. The initial point for soundings is on right bank of stream. The distances across stream are marked on the footbridge at intervals of 2 feet. The channel is straight for 50 feet above and for 40 feet below the footbridge. The current is swift. Both banks are high and rocky and are not liable to overflow. The bed of the stream is composed of gravel and is not subject to much change. The bench mark is a point marked on a lava rock 15 feet east of the left end of the footbridge.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Rock Creek near Round Valley, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 3	R. S. Hawley	1.55	20.0
August 8	do	1.62	21.0
August 18	do	1.55	19.5
September 1	do	1.42	16.8
September 10	do	1.49	17.5
November 24	do	1.51	18.3
December 29	do	1.45	18.1
1904.			
March 4	R. S. Hawley	1.20	14.3
March 28	do	1.40	26
April 8	E. C. Murphy, S. G. Bennett, and R. S. Hawley	1.28	22
April 27	R. S. Hawley	1.10	15.3
June 2	do	2.40	64
June 15	do	2.76	98
July 13	J. C. Clausen and L. M. Barnes	2.00	54
August 3	L. M. Barnes	2.30	72
September 9	R. S. Hawley	1.30	22
October 13	W. B. Clapp, R. J. Taylor, and R. S. Hawley	1.90	50
November 12	R. J. Taylor	1.68	37
December 6	do	1.39	24

Mean daily gage height, in feet, of Rock Creek near Round Valley, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	.....	.....	.....	.....	.....	.....	.....	.....	1.40	1.35	1.40	1.50
2	.....	.....	.....	.....	.....	.....	.....	.....	1.45	1.30	1.40	1.50
3	.....	.....	.....	.....	.....	.....	.....	.....	1.40	1.30	1.40	1.50
4	.....	.....	.....	.....	.....	.....	.....	[a]1.55	1.40	1.30	1.40	1.50
5	.....	.....	.....	.....	.....	.....	.....	1.50	1.40	1.35	1.40	1.50
6	.....	.....	.....	.....	.....	.....	.....	1.60	1.45	1.30	1.45	1.55
7	.....	.....	.....	.....	.....	.....	.....	1.60	1.40	1.30	1.50	1.55
8	.....	.....	.....	.....	.....	.....	.....	1.60	1.45	1.30	1.50	1.55
9	.....	.....	.....	.....	.....	.....	.....	1.55	1.45	1.30	1.50	1.55
10	.....	.....	.....	.....	.....	.....	.....	1.60	1.50	1.35	1.40	1.55
11	.....	.....	.....	.....	.....	.....	.....	1.60	1.55	1.30	1.40	1.60
12	.....	.....	.....	.....	.....	.....	.....	1.70	1.60	1.30	1.40	1.60
13	.....	.....	.....	.....	.....	.....	.....	1.70	1.60	1.30	1.40	1.60
14	.....	.....	.....	.....	.....	.....	.....	1.60	1.55	1.30	1.40	1.60
15	.....	.....	.....	.....	.....	.....	.....	1.50	1.50	1.30	1.40	1.60
16	.....	.....	.....	.....	.....	.....	.....	1.60	1.40	1.30	1.45	1.60
17	.....	.....	.....	.....	.....	.....	.....	1.60	[b]1.00	1.30	1.50	1.60
18	.....	.....	.....	.....	.....	.....	.....	1.55	1.50	1.30	1.50	1.60
19	.....	.....	.....	.....	.....	.....	.....	1.50	1.50	1.30	1.50	1.60
20	.....	.....	.....	.....	.....	.....	.....	1.50	1.50	1.30	1.50	1.60
21	.....	.....	.....	.....	.....	.....	.....	1.45	1.50	1.30	1.50	1.60
22	.....	.....	.....	.....	.....	.....	.....	1.50	1.55	1.30	1.50	1.50
23	.....	.....	.....	.....	.....	.....	.....	1.60	1.50	1.30	1.50	1.50
24	.....	.....	.....	.....	.....	.....	.....	1.60	1.50	1.30	1.50	1.55
25	.....	.....	.....	.....	.....	.....	.....	1.50	1.55	1.30	1.50	1.50
26	.....	.....	.....	.....	.....	.....	.....	1.50	1.50	1.30	1.50	1.50
27	.....	.....	.....	.....	.....	.....	.....	1.50	1.50	1.30	1.50	1.45
28	.....	.....	.....	.....	.....	.....	.....	1.45	1.40	1.30	1.50	1.45
29	.....	.....	.....	.....	.....	.....	.....	1.40	1.30	1.30	1.50	1.45
30	.....	.....	.....	.....	.....	.....	.....	1.40	1.30	1.40	1.50	1.45
31	.....	.....	.....	.....	.....	.....	.....	1.40	.....	1.40	.....	1.45
1904.												
1	1.55	1.5	1.3	1.3	1.2	2.4	2.4	2.25	1.4	1.9	1.75	1.45
2	1.55	1.5	1.25	1.3	1.2	2.4	2.4	2.35	1.4	1.9	1.7	1.45
3	1.55	1.5	1.3	1.35	1.2	2.7	2.3	2.3	1.35	1.9	1.7	1.4
4	1.55	1.5	1.3	1.3	1.2	2.6	2.5	2.25	1.4	1.8	1.75	1.4
5	1.55	1.5	1.3	1.3	1.25	2.6	2.6	2.25	1.4	1.8	1.75	1.45
6	1.55	1.3	1.3	1.3	1.25	2.7	2.5	2.2	1.35	1.8	1.75	1.45
7	1.55	1.35	1.2	1.3	1.2	2.7	2.5	2.2	1.3	1.9	1.7	1.5
8	1.4	1.35	1.25	1.3	1.2	2.4	2.5	2.15	1.2	1.9	1.7	1.5
9	1.4	1.5	1.25	1.3	1.25	2.4	2.5	2.1	1.2	1.9	1.7	1.55
10	1.5	1.5	1.25	1.2	1.25	2.6	2.4	2.3	1.2	2.0	1.7	1.55
11	1.5	1.5	1.3	1.3	1.9	2.6	2.2	2.4	1.2	2.3	1.75	1.55
12	1.5	1.5	1.2	1.3	1.9	2.7	2.0	2.2	1.2	2.2	1.7	1.55
13	1.5	1.5	1.3	1.2	2.0	2.8	1.95	2.2	1.2	2.0	1.7	1.5
14	1.5	1.5	1.3	1.2	2.0	2.7	1.8	2.15	1.2	1.95	1.7	1.4
15	1.45	1.5	1.3	1.2	2.05	2.75	1.7	2.1	1.3	1.9	1.7	1.4
16	1.45	2.1	1.2	1.2	2.1	2.9	1.6	2.15	1.35	1.8	1.7	1.35
17	1.4	1.35	1.25	1.3	2.2	2.9	1.75	2.0	1.3	1.8	1.65	1.35
18	1.4	1.3	1.3	1.3	2.1	2.8	1.75	2.25	1.3	1.8	1.60	1.35
19	1.4	1.3	1.3	1.3	2.1	2.8	1.7	2.1	1.35	1.9	1.6	1.4
20	1.4	1.35	1.5	1.3	2.1	2.75	1.7	1.8	1.4	1.9	1.6	1.4

[a] Given as 1.10, probably is 1.55.

[b] Probably is 1.50.

Mean daily gage height, in feet, of Rock Creek near Round Valley, Cal., etc.—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
21	1.35	1.3	1.4	1.3	2.2	2.75	2.0	1.8	1.3	1.9	1.65	1.45
22	1.3	1.3	1.5	1.3	2.1	2.8	2.2	1.8	1.3	1.8	1.7	1.45
23	1.3	1.3	1.6	1.3	2.0	2.8	2.3	1.9	1.35	1.8	1.7	1.4
24	1.3	1.3	1.4	1.3	2.4	2.7	2.2	2.35	2.0	1.8	1.6	1.35
25	1.3	1.3	1.4	1.25	2.8	2.6	2.15	2.2	2.3	1.8	1.5	1.35
26	1.3	1.3	1.4	1.3	2.4	2.5	2.1	2.1	2.0	1.8	1.5	1.35
27	1.45	1.3	1.4	1.3	2.4	2.5	2.1	2.1	1.9	1.8	1.5	1.4
28	1.5	1.4	1.4	1.3	2.45	2.6	2.15	1.9	1.9	1.8	1.5	1.4
29	1.5	1.3	1.55	1.2	2.4	2.6	2.0	1.9	1.9	1.8	1.5	1.4
30	1.5	.....	1.4	1.2	2.4	2.5	2.0	1.8	1.9	1.75	1.5	1.5
31	1.5	.....	1.4	.....	2.4	.....	2.2	1.8	.....	1.75	.....	1.75

Rating table for Rock Creek near Round Valley, Cal., from August 4, 1903, to February 16, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	15	1.60	22	1.90	32	2.10	40
1.40	17	1.70	25	2.00	35	2.20	44
1.50	19	1.80	28				

Rating table for Rock Creek near Round Valley, Cal., from February 17 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	12	1.60	34	2.10	58	2.60	88
1.10	15	1.70	38	2.20	63	2.70	95
1.20	18	1.80	43	2.30	69	2.80	102
1.30	22	1.90	48	2.40	75	2.90	109
1.40	26	2.00	53	2.50	81	3.00	116
1.50	30						

Estimated monthly discharge of Rock Creek near Round Valley, Cal., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
August 4–31	25	17	20	1,111
September	22	15	18	1,071
October	17	15	15	922
November	19	17	18	1,071
December	22	18	20	1,230
The period				5,405
1904.				
January	20	15	17.4	1,070
February	40	15	20.5	1,179
March	34	18	23.6	1,451
April	22	18	21	1,250
May	102	18	50	3,074
June	109	75	91.7	5,456
July	88	34	60.5	3,720
August	75	43	59	3,628
September	69	18	29	1,726
October	69	41	47	2,890
November	41	30	36	2,142
December	40	24	27.7	1,703
The year	109	15	40.3	29,289

PINE CREEK NEAR ROUND VALLEY, CAL.

This station was established August 3, 1903, by J. C. Clausen and R. S. Hawley. It is located 150 feet below the wagon bridge on the road from Bishop to Long Valley and 100 feet above the mouth of the creek. The gage is a 1 by 3 inch vertical rod fastened in the rocks near the right bank. It is read once each day by Roscoe Jones. Discharge measurements are made by wading. The initial point for soundings is a stake on the right bank of the stream.

The channel is straight for about 50 feet above and for about 100 feet below the station. The current has a velocity of about 1 foot per second at ordinary stages. Both banks are high and rocky and are not liable to overflow. The bed of the stream is rocky and permanent. The bench mark is the one at the Rock Creek station. It is a point marked on the lava rock 15 feet east of the left end of the footbridge.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Pine Creek near Round Valley, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 3	R. S. Hawley	1.90	15.0
August 8	do	1.87	10.4
August 18	do	1.73	5.7
September 1	do	1.71	5.9
September 10	do	1.71	6.3
November 24	do	1.89	10.1
1904.			
April 27	R. S. Hawley	1.70	4.2
June 2	do	2.80	67
June 15	do	3.70	185
July 13	J. C. Clausen and L. M. Barnes	2.95	84
August 3	L. M. Barnes	2.70	58
September 9	R. S. Hawley	1.87	10.7
October 13	R. S. Hawley, W. B. Clapp, and R. J. Taylor	2.30	31
November 12	R. J. Taylor	2.07	21
December 6	do	1.90	16

Mean daily gage height, in feet, of Pine Creek near Round Valley, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1									1.75	1.80	1.90	1.85
2									1.75	1.83	1.90	1.85
3									1.72	1.80	1.90	1.85
4								1.90	1.70	1.80	1.90	1.90
5								1.90	1.70	1.80	1.90	1.90
6								1.90	1.72	1.80	1.85	1.95
7								1.90	1.73	1.80	1.80	1.95
8								1.90	1.70	1.82	1.90	1.95
9								1.80	1.72	1.80	1.90	1.95
10								1.80	1.75	1.80	1.90	1.95
11								1.80	1.70	1.83	1.90	1.90
12								1.90	1.70	1.80	1.90	1.90
13								1.90	1.70	1.80	1.90	1.90
14								1.80	1.70	1.82	1.90	1.90
15								1.80	1.70	1.90	1.90	1.90
16								1.80	1.70	1.80	1.90	1.90
17								1.80	1.70	1.90	1.90	1.90
18								1.73	1.70	1.90	1.90	1.90
19								1.70	1.70	1.93	1.90	1.90
20								1.70	1.70	1.92	1.90	1.90
21								1.70	1.70	1.90	1.80	1.90
22								1.72	1.70	1.90	1.80	1.85
23								1.80	1.73	1.90	1.85	1.85

Mean daily gage height, in feet, of Pine Creek near Round Valley, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
24	.....	.....	.....	.....	.....	.....	.....	1.75	1.72	1.90	1.90	1.80
25	.....	.....	.....	.....	.....	.....	.....	1.80	1.70	1.90	1.90	1.85
26	.....	.....	.....	.....	.....	.....	.....	1.80	1.70	1.90	1.90	1.85
27	.....	.....	.....	.....	.....	.....	.....	1.75	1.70	1.90	1.85	1.90
28	.....	.....	.....	.....	.....	.....	.....	1.73	1.75	1.90	1.85	1.90
29	.....	.....	.....	.....	.....	.....	.....	1.70	1.80	1.90	1.85	1.90
30	.....	.....	.....	.....	.....	.....	.....	1.70	1.80	1.90	1.80	1.90
31	.....	.....	.....	.....	.....	.....	.....	1.70	.....	1.90	.....	1.90
1904.												
1	1.90	1.90	1.90	1.90	1.80	2.60	3.10	2.90	2.20	2.00	2.30	2.00
2	1.90	1.90	1.90	1.90	1.75	2.80	3.00	2.85	2.10	2.00	2.25	2.00
3	1.90	1.90	1.90	1.90	1.75	3.85	3.00	2.80	1.95	2.00	2.25	2.00
4	1.90	1.90	1.90	1.90	1.75	3.60	3.10	2.70	1.90	2.00	2.25	2.00
5	1.90	1.90	1.90	1.85	1.75	3.60	3.20	2.60	1.85	2.00	2.25	2.00
6	1.90	1.85	1.90	1.85	1.80	3.50	3.20	2.55	1.80	2.00	2.15	2.00
7	1.90	1.85	1.80	1.90	1.80	3.50	3.10	2.55	1.80	2.10	2.10	2.00
8	1.90	1.85	1.80	1.90	1.80	3.20	3.10	2.50	1.80	2.30	2.15	2.00
9	1.90	1.90	1.80	1.90	1.80	3.10	3.10	2.50	1.80	2.30	2.15	2.00
10	1.90	1.90	1.90	1.80	1.85	3.50	3.10	2.45	1.80	2.30	2.20	2.00
11	1.90	1.90	1.90	1.80	1.80	3.50	3.00	2.50	1.80	2.50	2.20	2.00
12	1.90	1.90	1.80	1.80	1.80	3.60	3.00	2.45	1.80	2.40	2.20	2.00
13	1.90	1.90	1.90	1.80	1.80	3.60	2.95	2.45	1.80	2.25	2.20	2.00
14	1.90	1.90	1.90	1.70	1.80	3.50	2.70	2.45	1.80	2.35	2.20	2.00
15	1.90	1.90	1.90	1.70	1.80	3.70	2.50	2.50	1.80	2.25	2.15	2.00
16	1.90	2.10	1.85	1.70	1.80	3.80	2.50	2.55	1.85	2.25	2.15	2.00
17	1.90	1.90	1.90	1.80	1.85	3.80	2.45	2.40	1.80	2.10	2.10	2.00
18	1.90	1.85	1.90	1.80	1.80	3.70	2.40	2.45	1.80	2.10	2.10	2.00
19	1.90	1.90	1.90	1.80	1.80	3.60	2.40	2.40	1.80	2.10	2.10	2.00
20	1.90	1.90	1.90	1.80	1.90	3.50	2.40	2.40	1.80	2.10	2.10	2.00
21	1.90	1.90	1.90	1.80	1.90	3.40	2.40	2.40	1.80	2.20	2.10	2.00
22	1.90	1.90	2.00	1.80	1.90	3.40	2.60	2.35	1.80	2.20	2.00	1.95
23	1.90	1.85	2.10	1.80	1.80	3.30	2.65	2.35	1.80	2.20	2.00	1.90
24	1.90	1.85	2.00	1.80	2.50	3.50	2.65	2.40	2.00	2.20	2.10	1.90
25	1.90	1.90	1.90	1.80	3.00	3.40	2.70	2.40	2.20	2.20	2.10	1.90
26	1.90	1.90	1.90	1.80	2.80	3.20	2.80	2.40	1.95	2.20	2.10	1.90
27	1.90	1.80	1.90	1.80	2.70	3.30	2.90	2.40	1.95	2.20	2.10	1.90
28	1.90	1.90	.....	1.80	2.60	3.30	2.80	2.25	1.90	2.25	2.10	1.95
29	1.90	1.90	1.90	1.80	2.70	3.40	2.65	2.25	1.90	2.25	2.00	2.00
30	1.90	.....	1.90	1.80	2.70	3.20	2.70	2.20	1.90	2.30	2.00	2.00
31	1.90	.....	1.90	.....	2.60	.....	2.85	2.20	.....	2.30	.....	2.30

Rating table for Pine Creek near Round Valley, Cal., from August 4, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.70	4	2.30	33	2.90	75	3.50	149
1.80	8	2.40	39	3.00	85	3.60	165
1.90	13	2.50	45	3.10	95	3.70	184
2.00	18	2.60	52	3.20	106	3.80	203
2.10	23	2.70	59	3.30	119	3.90	223
2.20	28	2.80	67	3.40	133		

Estimated monthly discharge of Pine Creek near Round Valley, Cal., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
August 4–31	13	4	7.9	439
September	8	4	4.7	280
October	14	8	10.8	664
November	13	8	11.8	702
December	16	8	12.6	775
The period				2,860
1904.				
January	13	13	13	799
February	23	8	12.4	713
March	23	8	12.9	793
April	13	5	9	536
May	85	6	21.7	1,334
June	213	52	142	8,450
July	106	39	70	4,304
August	75	28	44	2,705
September	28	8	12	714
October	45	18	28	1,722
November	33	18	25	1,488
December	33	13	17.5	1,076
The year	213	5	34	24,634

OWENS RIVER CANAL NEAR BISHOP, CAL.

This station was established August 5, 1903, by J. C. Clausen and R. S. Hawley. It is located at the footbridge near the quarter-section line which divides the north half of sec. 27, T. 6 S., R. 32 E., of the Mount Diablo meridian. The gage is a vertical rod nailed to the bridge. It is read once each day by A. S. Kinsley, the ditch tender. Discharge measurements are made from the footbridge to which the gage is attached. The initial point for soundings is on right bank of canals. The distances across stream are marked on the bridge at intervals of 2 feet. The channel is straight for 300 feet above and for 100 feet below the station. The current is sluggish. The right bank is high and rocky and will not overflow. The left bank is low and will overflow. The bed of the stream is composed of gravel and is permanent.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Owens River canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
July 30	R. S. Hawley		39.0
August 5	do	2.50	21.8
August 15	do	2.69	28.6
August 26	do	2.82	36.5
September 7	do	2.89	33.1
September 15	do	3.02	39.5
October 23	do	2.57	23.2
1904.			
February 3	R. S. Hawley	1.60	7.4
March 4	do	2.90	44
March 21	do	2.60	34
April 21	do	2.90	46
July 11	J. C. Clausen and L. M. Barnes	2.65	31
August 10	L. M. Barnes	2.80	40
September 5	R. S. Hawley	2.90	40
October 14	R. S. Hawley, W. B. Clapp, and R. J. Taylor	1.65	6.1
November 1	R. J. Taylor	1.60	4.6

Mean daily gage height, in feet, of Owens River canal near Bishop, Cal., for 1903.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1		2.90	3.10	12	2.80	3.00		22	2.85	3.00	
2		2.90	3.10	13	2.80	3.05		23	2.85	3.00	
3		2.90	3.10	14	2.80	3.05		24	2.85	3.00	
4		2.95	3.10	15	(b)	3.05		25	2.80	3.00	
5	a 2.50	2.95	3.10	16	(b)	3.05		26	2.80	3.05	
6	2.50	(b)	3.10	17	2.75	3.05		27	2.85	3.05	
7	2.50	2.95	3.10	18	2.80	3.05		28	2.85	3.05	
8	(b)	2.90	3.10	19	(b)	3.10		29	2.90	(b)	
9	2.70	2.90	3.10	20	2.80	3.10		30	2.90	3.10	
10	2.75	2.95	2.70	21	(b)	(b)		31	2.90		
11	(b)	3.00									

a Lowest water known in twenty-four years. b No record.

On October 10 the directors of the canal ordered part of the water turned off; irrigation was practically over for season. From October 10 no daily record was kept, but beginning October 11 the gage read about 1.60 until October 24; the water was then all turned out.

Mean daily gage height, in feet, of Owens River canal near Bishop, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	a 0.00	0.00	0.00						
2	.00	1.6	.00		2.9				2.75
3	.00	1.6	.00	2.6	2.9				
4	.00		2.9		2.9			2.65	
5	.00				2.9	2.7	2.6		28.
6	.00		2.7		2.9			2.8	2.95
7	.00				2.9	2.7	2.6		2.9
8	.00			2.7		2.6			3.0
9	.00				2.9				3.0
10	.00				2.9				
11	.00				2.9		2.65	2.7	
12	.00			2.75					
13	.00			2.80	2.9	2.6			3.0
14	.00			2.85					
15	.00			2.85		2.4		2.7	
16	.00	a .00			2.9				
17	.00	.00		2.85	2.9				3.05
18	.00	.00			2.9				
19	.00	.00		2.85					
20	.00	.00		2.80	2.9			2.8	3.05
21	.00	.00	2.6	2.9	2.9				(b)
22	.00	.00		2.9		2.6			
23	.00	.00			2.9				
24	.00	.00		2.9	2.9				
25	.00	.00			2.9			2.8	
26	.00	.00		2.9			2.7		
27	.00	.00		2.9		2.5	2.75		
28	.00	.00							
29	.00	.00	2.7	2.9	2.7				
30	.00						2.		
31	.00		2.6						

a Dry January 1 to February 1; February 16 to March 3.
b No record for remainder of the year.

Rating table for Owens River canal near Bishop, Cal., from January 1 to June 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	7	2.00	15	2.40	27	2.80	42
1.70	9	2.10	18	2.50	31	2.90	46
1.80	11	2.20	20	2.60	34	3.00	50
1.90	13	2.30	23	2.70	38	3.10	54

Rating table for Owens River canal near Bishop, Cal., from July 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	5	2.00	13	2.40	24	2.80	37
1.70	6	2.10	16	2.50	27	2.90	41
1.80	8	2.20	18	2.60	30	3.00	45
1.90	11	2.30	21	2.70	34		

Estimated monthly discharge of Owens River canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	7	0	3.4	196
March	46	0	33	2,029
April	46	34	41.4	2,464
May	46	38	45	2,767
June	38	31	33.5	1,993
July	37	27	33	2,029
August	37	32	35	2,152
September 1–20	47	35	43	1,706
The period				15,336

NOTE.—Discharge interpolated for missing days.

BISHOP CREEK CANAL NEAR BISHOP, CAL.

This station was established August 5, 1903, by J. C. Clausen, assisted by R. S. Hawley. It is located at the footbridge below the waste gate near the house of the observer, A. Fitzgerald. It is 3½ miles northwest of Bishop, Cal. The gage is a 1 by 3 inch vertical rod fastened to the bridge anchor. Discharge measurements are made from the footbridge at which the gage is located. The initial point for soundings is on right bank; the initial point and points at which soundings are made are marked on footbridge. The channel is straight for 50 feet above and for 100 feet below this station. The current is swift. The right bank is high and the left bank is low. Neither bank is liable to overflow. The bed of the stream is composed of sand and gravel and is fairly permanent. The gaging stations on canals taking water from Owens River may be considered as temporary. The gage rods in most instances are securely fastened to the footbridges and are not likely to change. No permanent bench marks were established.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Bishop Creek canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
July 30	R. S. Hawley		101
August 5	do	3.0	72
August 15	do	2.89	61
August 26	do	3.25	84
September 5	do	3.17	81
September 15	do	3.31	82
October 23	do	1.97	27
1904.			
February 11	R. S. Hawley	2.43	54
March 21	do	1.75	22
April 13	do	3.69	116
April 21	do	3.62	113
May 14	do	3.55	109
June 16	do	1.90	30
June 11	J. C. Clausen and L. M. Barnes	3.20	94
August 10	L. M. Barnes	2.00	26
September 5	R. S. Hawley	4.10	118

Mean daily gage height, in feet, of Bishop Creek canal near Bishop, Cal., for 1903.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1				12				22	3.10	3.30	
2		3.15		13				23		3.30	
3		3.15		14	3.10			24		3.40	
4				15	2.90	3.30		25		3.40	
5	3.00	3.15		16		3.30		26	3.25	3.40	
6	3.10		2.00	17		3.25		27		3.40	
7				18	3.10	3.25		28		3.40	
8	3.10	3.30		19	3.00	3.30		29		([a])	
9				20		3.30		30			
10	3.10	3.30		21		3.30		31			
11	3.10										

[a] No record until October 6; but not much change in the canal.

NOTE.—On October 6 the head-gate was shut down, and until October 29, when the water was turned out, the gage read about 2.0 feet.

Mean daily gage height, in feet, of Bishop Creek canal near Bishop, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[a]0.00	0.00	0.00			3.5	2.6	3.8		[a]0.00	0.00	0.00
2	.00	.00	.00			3.5	2.6	3.0				
3	.00	.00	.00		3.3	3.5	2.6	3.0				
4	.00	.00	.00	1.7	3.3	3.7		3.0				
5	.00	.00	.00		3.2	2.0	3.2	3.0	4.0			
6	.00	.00	.00	1.7	3.2	2.0	3.2	2.0	3.9			
7	.00	.00	.00	2.7	3.2	2.0	3.3	2.0	3.9			
8	.00	.00	.00	2.7	3.3	2.2	3.3	2.0	4.05			
9	.00	[a].00	.00		3.3	2.2	3.3	2.0	4.0			
10	.00	2.45	.00	2.7	3.3			2.0	4.0			
11	.00		.00	2.7	3.3			2.1				
12	.00		.00	3.7		1.7	3.2	2.1	4.05			
13	.00	2.45	.00	3.7	3.8	1.7	3.2					
14	.00		.00		3.8	1.7	3.1	2.0	4.1			
15	.00		.00	3.7	3.8	1.7	3.1	3.3				
16	.00	2.45	.00	3.5	3.7	1.7	3.1	3.3	4.05			
17	.00		.00			1.7	3.6	3.3	4.05			
18	.00		.00	3.5	3.8	1.7	3.6	3.4				
19	.00	2.45	.00	3.6	3.7		3.6	3.35	4.1			
20	.00		[a].00		3.7	1.8	3.6	3.35	3.4			
21	.00		1.75		3.7	1.8	3.6		3.4			
22	.00			3.6	3.7	1.8	3.6	3.7	3.4			
23	.00	2.45		3.3	3.7	1.8	3.6	3.7	3.4			
24	.00	[a].00			3.3	1.8		3.7	3.45			
25	.00	.00		3.3	3.3	1.8	3.7					
26	.00	.00		3.3	3.3		3.7					
27	.00	.00		3.3	3.3	2.6	3.7					
28	.00	.00		3.6	3.2	2.6	3.7					
29	.00	.00		3.6	3.2	2.6	3.7					
30	.00			3.6	3.2	2.6	3.8		3.9			
31	.00						3.8					[a].00

[a] Canal dry: January 1 to February 9, February 24 to March 20; October 1 to December 31.

Rating table for Bishop Creek canal near Bishop, Cal., from February 1 to October 1, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	15	2.30	48	3.00	81	3.70	116
1.70	20	2.40	53	3.10	86	3.80	121
1.80	24	2.50	57	3.20	91	3.90	126
1.90	28	2.60	62	3.30	96	4.00	131
2.00	33	2.70	67	3.40	101	4.10	136
2.10	38	2.80	72	3.50	106	4.20	141
2.20	43	2.90	76	3.60	111		

Estimated monthly discharge of Bishop Creek canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	55	0	26.5	1,524
March	22	0	7.8	480
April	116	20	83.1	4,945
May	121	91	103.4	6,359
June	106	20	42.1	2,505
July	121	62	99	6,087
August	126	33	85	5,226
September	136	101	123	7,319
The period				34,445

NOTE.—Discharge interpolated for missing days.

FARMERS' CANAL NEAR BISHOP, CAL.

This station was established August 6, 1903, by J. C. Clausen and R. S. Hawley. It is located at the footbridge near the house of the observer, Robert Love, and 3 miles north of Bishop, Cal. The gage is a 1 by 3 inch vertical rod fastened to the bridge pier. Discharge measurements are made from the footbridge, to which the gage is attached. The initial point for soundings is on footbridge, near the right bank. The distances across stream are marked every 2 feet on the footbridge.

The channel is straight for 300 feet above and for 50 feet below the station. The current is sluggish. Both banks are low and are liable to overflow. The bed of the stream is sandy and shifting.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Farmers' canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
July 31	R. S. Hawley		13.9
August 6	do	2.4	7.0
August 17	do	2.7	14.2
August 25	do	2.5	10.7
September 3	do	2.42	9.7
September 14	do	2.58	10.4
October 23	do	2.55	16.2
November 27	do	[a] 2.54	16.0
1904.			
February 3	R. S. Hawley	2.55	15.5
April 2	do	2.35	11.3
April 20	do	2.60	17.0
May 14	do	2.83	27.0
June 16	do	3.02	22.0
July 11	J. C. Clausen and L. M. Barnes	2.55	15.0
July 30	L. M. Barnes	3.05	24.0
August 25	do	3.05	26.0
September 6	R. S. Hawley	2.80	21.0
October 14	R. S. Hawley, W. B. Clapp, and R. J. Taylor	2.41	8.1
November 1	R. J. Taylor	2.40	8.1
December 1	do	2.30	7.2

[a] Corrected gage height.

Mean daily gage height, in feet, of Farmers' canal near Bishop, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1									2.40	2.95	2.55	2.50
2									2.40	2.95		
3									2.43	2.95	2.55	2.50
4									2.40	3.00		
5									2.45	3.03	2.55	2.50
6									2.45			
7								2.40	2.50	3.05	2.55	2.50
8								2.33	2.58		2.55	
9								2.40	2.67	2.82	(2.55)	2.50
10								2.60	2.65		(2.55)	
11								2.60		2.80	(2.55)	2.50
12								2.67	2.68		(2.55)	
13								2.75	2.57	2.80	(2.55)	2.50
14									2.60		2.55	
15									2.60		2.55	2.48
16								2.70	2.63	2.90	(2.55)	
17								2.70		[a] 2.50	(2.55)	2.50

[a] The rock dam below the gage rod was partly removed.

Mean daily gage height, in feet, of Farmers' canal near Bishop, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
18	.....	.....	.....	.....	.....	.....	.....	2.68	2.67	.....	(2.55)	.....
19	.....	.....	.....	.....	.....	.....	.....	.....	2.80	2.60	(2.55)	2.45
20	.....	.....	.....	.....	.....	.....	.....	2.50	2.82	2.50	(2.55)	.....
21	.....	.....	.....	.....	.....	.....	.....	.....	2.85	2.50	2.55	2.50
22	.....	.....	.....	.....	.....	.....	.....	2.50	2.83	2.50	2.55	.....
23	.....	.....	.....	.....	.....	.....	.....	2.50	.....	2.55	(2.55)	2.48
24	.....	.....	.....	.....	.....	.....	.....	2.55	2.87	.....	(2.55)	.....
25	.....	.....	.....	.....	.....	.....	.....	2.50	.....	.....	(2.55)	2.50
26	.....	.....	.....	.....	.....	.....	.....	2.50	2.90	2.53	(2.55)	.....
27	.....	.....	.....	.....	.....	.....	.....	2.55	2.93	.....	(2.55)	2.50
28	.....	.....	.....	.....	.....	.....	.....	2.50	2.90	.....	2.55	.....
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.55	.....	2.50
30	.....	.....	.....	.....	.....	.....	.....	2.45	2.92	.....	.....	.....
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.50
1904.												
1	.....	2.55	2.3	.....	.....	2.65	2.65	3.00	3.00	2.50	2.40	2.30
2	2.5	.....	.....	2.35	2.3	.....	.....	.....	3.10	.....	.....	.....
3	.....	2.55	.....	2.5	2.1	2.75	2.60	3.05	3.05	2.45	2.35	.....
4	2.5	.....	.....	.....	.....	.....	2.60	.....	.....	.....	.....	.....
5	.....	.....	.....	.....	2.4	2.75	.....	3.10	.....	2.50	.....	.....
6	2.5	2.55	.....	.....	2.5	.....	2.55	.....	2.80	.....	.....	2.30
7	.....	2.5	.....	2.3	.....	.....	.....	3.05	2.80	2.55	.....	.....
8	.....	.....	.....	.....	.....	.....	2.55	.....	2.75	.....	2.30	.....
9	2.5	.....	.....	.....	.....	.....	.....	3.10	.....	2.45	.....	2.30
10	.....	.....	.....	2.3	.....	3.05	.....	.....	2.70	.....	.....	.....
11	2.5	.....	.....	.....	2.6	.....	2.60	3.05	.....	2.45	2.30	.....
12	.....	.....	.....	2.3	.....	.....	.....	.....	2.70	.....	.....	.....
13	2.5	.....	.....	.....	2.6	3.10	2.55	3.10	2.75	2.40	.....	2.25
14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	.....	.....	.....	2.3	2.65	.....	2.50	3.10	2.70	2.40	2.30	.....
16	2.55	.....	.....	.....	2.85	.....	.....	.....	.....	.....	.....	2.25
17	.....	.....	.....	.....	.....	3.1	2.70	3.10	2.75	.....	.....	.....
18	2.5	.....	.....	.....	2.95	.....	.....	.....	2.80	2.40	2.25	.....
19	.....	.....	.....	2.3	.....	.....	.....	3.05	.....	.....	.....	.....
20	.....	.....	.....	2.6	2.75	3.0	.....	.....	2.90	.....	.....	2.30
21	2.5	.....	.....	.....	.....	.....	.....	.....	2.95	2.35	.....	.....
22	.....	.....	.....	2.9	.....	.....	.....	3.10	.....	.....	2.30	.....
23	2.55	.....	.....	.....	2.65	.....	.....	3.15	3.00	.....	.....	2.30
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	.....	.....	.....	2.0	2.6	.....	.....	3.05	.....	2.40	2.30	.....
26	2.55	.....	.....	.....	.....	.....	.....	.....	3.10	.....	.....	.....
27	.....	.....	.....	1.9	.....	.....	.....	.....	2.70	.....	.....	2.20
28	.....	.....	.....	0	2.65	.....	.....	.....	2.60	2.40	.....	.....
29	2.55	.....	.....	0	.....	2.6	.....	.....	.....	.....	.....	.....
30	.....	.....	.....	0	2.70	2.9	3.05	3.10	2.60	.....	.....	.....
31	.....	.....	.....	.....	.....	.....	.....	3.10	.....	.....	.....	2.15

NOTE.—Gage heights in parenthesis are estimated.

Rating table for Farmers' canal near Bishop, Cal., from January 1 to May 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	4	2.30	10	2.60	18	2.90	30
2.10	6	2.40	12	2.70	21	3.00	35
2.20	8	2.50	15	2.80	25	3.10	40

Rating table for Farmers' canal near Bishop, Cal., from June 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.10	3	2.40	8	2.70	15	3.00	23
2.20	5	2.50	10	2.80	18	3.10	26
2.30	6	2.60	13	2.90	21	3.20	29

Estimated monthly discharge of Farmers' canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	16	15	15.3	941
February	16	15	15.2	874
March	10	10	10	615
April	30	0	10.2	607
May	32	6	18.8	1,156
June	26	13	21	1,250
July	25	10	16	984
August	28	23	26	1,599
September	26	13	19	1,131
October	12	7	9	553
November	8	6	6	357
December	6	4	5.7	350
The year	32	0	14.4	10,417

NOTE.—Discharge interpolated for missing days.

M'NALLY CANAL NEAR BISHOP, CAL.

This station was established July 31, 1903, by J. C. Clausen and R. S. Hawley. It is located at the head of the canal, 3¾ miles north of Bishop, Cal. The gage is a 1 by 3 inch vertical board fastened to the headworks of the canal. Discharge measurements are made from a footbridge. The initial point for soundings is marked on the footbridge near the right bank. The channel is straight for 50 feet below

the gage. The current is swift. Both banks are high and will not overflow. The bed of the stream is rocky and permanent.

No gage reader could be obtained for this station, but since the gage was installed there has been little variation in the amount of water flowing in the canal.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of McNally canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
July 31	R. S. Hawley	1.40	66
August 6	do	1.40	66
August 17	do	1.36	63
August 25	do	1.25	54
September 4	do	1.25	52
September 14	do	1.26	52
September 21	do	1.10	40
1904.			
April 2	R. S. Hawley	.80	29
April 20	do	1.37	68
May 14	do	1.52	83
July 11	J. C. Clausen and L. M. Barnes	1.55	81
July 30	L. M. Barnes	1.90	81
August 25	do	1.70	50
September 5	R. S. Hawley	1.75	46

Mean daily gage height, in feet, of McNally canal near Bishop, Cal., for 1904. [a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Oct.	Nov.	Dec.
1	[b]0.00	0.00	0.00			1.50	1.60	0.00	0.00	0.00
2	.00	.00	.00	0.80				.00	.00	.00
3	.00	.00	.00			1.80		.00	.00	.00
4	.00	.00	.00					.00	.00	.00
5	.00	.00	.00					.00	.00	.00
6	.00	.00	.00			1.70		.00	.00	.00
7	.00	.00	.00			1.50		.00	.00	.00
8	.00	.00	.00	.90				.00	.00	.00
9	.00	.00	.00			1.70		.00	.00	.00
10	.00	.00	.00					.00	.00	.00
11	.00	.00	.00			1.30	1.55	.00	.00	.00
12	.00	.00	.00			1.50		.00	.00	.00
13	.00	.00	.00				1.90	.00	.00	.00
14	.00	.00	.00		1.52	1.60		.00	.00	.00
15	.00	.00	.00			1.50	1.80	.00	.00	.00

[a] Dry: January, February, March, October, November, and December.
[b] No record: August and September.

Mean daily gage height, in feet, of McNally canal near Bishop, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Oct.	Nov.	Dec.
16	0.00	0.00	0.00	.....	.....	.....	1.90	0.00	0.00	0.00
17	.00	.00	.00	.....	.....	.....	2.00	.00	.00	.00
18	.00	.00	.00	.....	.....	.....	2.10	.00	.00	.00
19	.00	.00	.00	.....	.....	.....	.....	.00	.00	.00
20	.00	.00	.00	1.35	.....	.....	.....	.00	.00	.00
21	.00	.00	.00	.....	.....	.....	.....	.00	.00	.00
22	.00	.00	.00	.....	.....	.....	.....	.00	.00	.00
23	.00	.00	.00	.....	.....	.....	.....	.00	.00	.00
24	.00	.00	.00	.....	.....	.....	.....	.00	.00	.00
25	.00	.00	.00	.....	.....	.....	.....	.00	.00	.00
26	.00	.00	.00	.....	.....	1.40	.....	.00	.00	.00
27	.00	.00	.00	.....	.....	.....	.....	.00	.00	.00
28	.00	.00	.00	.....	.....	.....	.....	.00	.00	.00
29	.00	.00	.00	.....	.....	.....	.....	.00	.00	.00
30	.00	.....	.00	.....	.....	.....	1.90	.00	.00	.00
31	.00	.....	.00	.....	.....	.....	.....	.00	.....	.00

Rating table for McNally canal near Bishop, Cal., from April 1 to July 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.70	22	1.10	50	1.50	78	1.90	106
.80	29	1.20	57	1.60	85	2.00	113
.90	36	1.30	64	1.70	92	2.10	120
1.00	43	1.40	71	1.80	99		

Rating table for McNally canal near Bishop, Cal., from August 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.40	10	1.60	30	1.80	62
1.50	20	1.70	45	1.90	82

Estimated monthly discharge of McNally canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	68	29	50.6	3,007
May	.....	.....	80	4,919
June	99	64	80	4,760
July	120	83	100	6,148
The period	.....	.....	.....	18,834

NOTE.—Discharge interpolated for missing days.

GEORGE COLLINS'S CANAL NEAR BISHOP, CAL.

This station was established August 17, 1903, by R. S. Hawley. It is located at the footbridge 3 miles east and one-half mile north of Bishop, Cal. The gage is a vertical rod fastened to the bridge near the house of Arthur Wines, the observer. Discharge measurements are made from the bridge. The initial point for soundings is marked on the footbridge near the right bank of the canal. The channel is straight for 75 feet above and for 50 feet below the station. The current is sluggish. The right bank is low and the left bank is high. Neither bank is liable to overflow. The bed of the stream is composed of sand and is fairly permanent.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of George Collins's canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
July 31	R. S. Hawley		4.9
August 11	do		5.6
August 17	do	1.00	6.3
August 27	do	1.01	6.0
September 7	do	.94	5.5
September 14	do	.98	5.5
October 23	do	.60	2.8
1904.			
February 4	R. S. Hawley	.30	1.5
April 2	do	1.20	11.1
April 14	do	.70	4.2
June 8	do	1.58	14.0
July 12	J. C. Clausen and L. M. Barnes	1.50	9.6
August 6	L. M. Barnes	1.50	9.7
August 20	do	1.55	9.3
October 10	R. S. Hawley and R. J. Taylor	1.03	1.8
November 1	R. J. Taylor	.80	.7

Mean daily gage height, in feet, of George Collins's canal near Bishop, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	.....	.....	.....	.....	.....	.....	.....	.....	1.03	0.95	0.75	0.75
2	.....	.....	.....	.....	.....	.....	.....	.....	.98	.95	.75	.75
3	.....	.....	.....	.....	.....	.....	.....	.....	.97	.95	.75	.75
4	.....	.....	.....	.....	.....	.....	.....	.....	.98	.95	.75	.75
5	.....	.....	.....	.....	.....	.....	.....	.....	.97	.95	.75	.70
6	.....	.....	.....	.....	.....	.....	.....	.....	.98	.95	.70	.65
7	.....	.....	.....	.....	.....	.....	.....	.....	.97	.95	.70	.65
8	.....	.....	.....	.....	.....	.....	.....	.....	.95	.95	.70	.65
9	.....	.....	.....	.....	.....	.....	.....	.....	.95	.95	.70	.65
10	.....	.....	.....	.....	.....	.....	.....	.....	.95	.95	.70	.65
11	.....	.....	.....	.....	.....	.....	.....	.....	.95	.95	.75	.65
12	.....	.....	.....	.....	.....	.....	.....	.....	.92	[a].80	.75	.65
13	.....	.....	.....	.....	.....	.....	.....	.....	.93	.80	.75	.63
14	.....	.....	.....	.....	.....	.....	.....	.....	.95	.80	.75	.62
15	.....	.....	.....	.....	.....	.....	.....	.....	.95	.80	.75	.63
16	.....	.....	.....	.....	.....	.....	.....	1.00	.95	.80	.75	.62
17	.....	.....	.....	.....	.....	.....	.....	.98	.95	.80	[b].50	.63
18	.....	.....	.....	.....	.....	.....	.....	.92	.97	.80	.50	.60
19	.....	.....	.....	.....	.....	.....	.....	.93	.95	.80	.50	.60
20	.....	.....	.....	.....	.....	.....	.....	.92	1.35	.80	.50	.60
21	.....	.....	.....	.....	.....	.....	.....	.70	1.35	.85	.55	([c])
22	.....	.....	.....	.....	.....	.....	.....	.73	1.35	.85	.55	.....
23	.....	.....	.....	.....	.....	.....	.....	.70	1.35	[d].75	.55	.....
24	.....	.....	.....	.....	.....	.....	.....	.90	1.35	.75	.55	.....
25	.....	.....	.....	.....	.....	.....	.....	.90	1.35	.75	.55	.....
26	.....	.....	.....	.....	.....	.....	.....	.90	1.35	.75	.55	.....
27	.....	.....	.....	.....	.....	.....	.....	.97	1.35	.75	.62	.....
28	.....	.....	.....	.....	.....	.....	.....	1.03	1.20	.75	.70	.....
29	.....	.....	.....	.....	.....	.....	.....	1.02	1.20	.75	.70	.....
30	.....	.....	.....	.....	.....	.....	.....	1.03	1.20	.75	.85	.....
31	.....	.....	.....	.....	.....	.....	.....	1.04	.....	.75	.....	.....
1904.												
1	[c]0.00	0.00	0.2	1.3	0.6	1.5	1.3	1.5	1.55	1.0	.....	.....
2	.00	.00	.2	1.3	.6	1.5	1.3	.....	.....	.....	.....	.....
3	.00	.00	.2	1.3	.6	1.5	1.3	1.5	1.49	1.3	.....	.....
4	.00	.00	.2	1.2	.6	1.6	.....	.....	1.1	1.3	.....	.....
5	.00	.00	.2	1.2	.6	.....	1.3	.....	.....	.....	.....	.....
6	.00	.00	.2	1.2	.7	.....	.....	1.5	.5	1.6	.....	.....
7	.00	.00	[e].00	1.2	.7	.....	1.4	.....	.....	.....	.....	.....
8	.00	.00	.00	1.2	.6	1.6	1.4	1.3	1.0	.....	.....	.....
9	.00	.00	.00	.9	.6	.....	1.4	.....	1.4	.....	.....	.....
10	.00	.00	.00	.9	.8	1.6	.....	1.5	.....	.....	.....	.....
11	.00	.2	.00	.9	.8	1.6	1.4	.....	1.5	.7	.....	.....
12	.00	.2	.00	.9	1.1	1.5	.....	1.5	.....	.....	.....	.....
13	.00	.2	.00	.7	1.3	1.6	1.35	.....	1.5	.6	.....	.....
14	.00	.2	.00	.7	1.3	.....	.....	1.5	.....	.....	.....	.....
15	.00	.2	.00	.7	1.6	1.5	1.3	.....	1.3	.....	.....	.....
16	.00	.3	.00	.7	1.6	.....	.....	1.5	1.1	1.0	.....	.....
17	.00	.6	.2	.8	1.6	1.6	1.3	.....	1.1	.9	.....	.....
18	.00	.3	.3	.8	1.6	.....	.....	1.6	1.4	.6	.....	.....

[a] Falling slowly; no storms.
[b] Falling fast.
[c] Canal turned off.
[d] Falling slightly.
[e] Dry; January 1 to February 10; March 7–16; March 21–22.

Mean daily gage height, in feet, of George Collins's canal near Bishop, Cal., etc.—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
19	0.00	0.2	0.2	0.9	1.6	1.5	1.2	.....	.....	.....	.....	.....
20	.00	.2	.2	1.0	1.6	.....	.....	1.5	1.4	.....	.....	.....
21	.00	.2	*a* .00	1.0	1.6	1.6	.8	.....	1.4	(*b*)	.....	.....
22	.00	.3	.00	1.0	1.5	.....	.....	1.5	.....	.....	.....	.....
23	.00	.3	.5	1.1	1.4	1.5	1.2	.....	1.5	.....	.....	.....
24	.00	.6	.3	1.1	1.5	.....	.....	1.55	.....	.....	.....	.....
25	.00	.5	.3	1.2	1.5	1.5	1.5	.....	.....	.....	.....	.....
26	.00	.5	1.4	1.1	1.5	1.5	.....	1.5	.....	.....	.....	.....
27	.00	.3	1.43	1.1	1.6	1.5	1.5	.....	.....	.....	.....	.....
28	.00	.4	1.4	1.0	1.6	1.4	.....	.....	.....	.....	.....	.....
29	.00	.4	1.4	.8	1.6	1.4	1.55	1.5	.....	.....	.....	.....
30	.00	.....	1.4	.6	1.6	1.3	1.5	.....	1.2	.....	.....	.....
31	.00	.....	1.3	.....	1.6	.....	1.5	1.55	.....	.....	.....	.....

a Dry: January 1 to February 10; March 7–16; March 21–22.
b Water shut off for remainder of year.

Rating table for George Collins's canal near Bishop, Cal., from January 1 to June 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.30	1	0.70	5	1.10	9	1.40	12
.40	2	.80	6	1.20	10	1.50	13
.50	3	.90	7	1.30	11	1.60	15
.60	4	1.00	8				

Rating table for George Collins's canal near Bishop, Cal., from July 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.80	0	1.10	3	1.30	6	1.50	9
.90	1	1.20	4	1.40	7	1.60	11
1.00	2						

Estimated monthly discharge of George Collins's canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	4	0	1.1	63
March	12	0	2.7	166
April	11	4	7.9	470
May	15	4	10.5	646
June	15	12	13.7	815
July	10	0	6	369
August	11	6	9	553
September	13	0	6	357
October 1–20	11	0	3	119
The period				3,558

NOTE.—Discharge interpolated for missing days.

BISHOP CREEK NEAR BISHOP, CAL.

This station was established August 10, 1903, by J. C. Clausen and R. S. Hawley. It is located at the wagon bridge on the Bishop road, about 4¼ miles from Bishop and about 2 miles from the point where the creek leaves the canyon. North Hillside canal, South Hillside canal, and Powers canal are taken out above the station. The gage is a 1 by 3 inch vertical rod fastened in the rocks and braced to the right bank just above the wagon bridge. It is read once each day by A. S. Kilpatrick. Discharge measurements are made from the wagon bridge. The initial point for soundings is marked on the bridge near the right bank of the stream. The channel is straight for 100 feet above and for 50 feet below the station. The current is swift. Both banks are high and rocky and are not liable to overflow. The bed of the stream is rough and rocky and is permanent. The bench mark is a large flat granite bowlder on the right bank, 40 feet above the bridge.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Bishop Creek near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage-height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 9	R. S. Hawley	2.45	121
August 19	do	2.17	95
August 25	do	2.20	96
September 3	do	1.99	[a]67
September 7	do	1.80	52
September 15	do	1.65	40
September 21	do	1.60	38
October 24	do	1.39	27
November 20	do	1.41	26
December 26	do	1.35	25
1904.			
January 23	R. S. Hawley	1.40	30
February 20	do	1.50	33
March 14	do	1.65	42
April 8	E. C. Murphy, S. G. Bennett, and R. S. Hawley	1.60	34
April 25	R. S. Hawley	2.05	75
April 30	do	2.00	67
May 17	do	2.95	180
June 8	do	3.65	342
July 12	J. C. Clausen and L. M. Barnes	3.00	197
August 8	L. M. Barnes	3.30	240
September 7	R. S. Hawley	2.10	74
October 15	R. S. Hawley, W. B. Clapp, and R. J. Taylor	2.30	95
November 9	R. J. Taylor	1.75	49
December 5	do	1.39	20

[a] Corrected discharge.

Mean daily gage height, in feet, of Bishop Creek near Bishop, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1									2.00	1.60	1.45	1.30
2									1.95	1.60	1.45	1.30
3									1.90	1.70	1.45	1.30
4									2.00	1.70	1.45	1.35
5									2.00	1.70	1.45	1.35
6									2.00	1.70	1.45	1.35
7									2.00	1.70	1.45	1.40
8									1.90	1.70	1.45	1.40
9									1.90	1.70	1.45	1.40
10									1.80	1.70	1.45	1.40
11								2.50	1.80	1.70	1.45	1.40

Mean daily gage height, in feet, of Bishop Creek near Bishop, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
12	.....	.....	.....	.....	.....	.....	.....	2.50	1.75	1.70	1.45	1.40
13	.....	.....	.....	.....	.....	.....	.....	2.50	1.75	1.70	1.45	1.40
14	.....	.....	.....	.....	.....	.....	.....	2.40	1.70	1.70	1.45	1.40
15	.....	.....	.....	.....	.....	.....	.....	2.30	1.70	1.65	1.45	1.40
16	.....	.....	.....	.....	.....	.....	.....	2.30	1.65	1.65	1.45	1.45
17	.....	.....	.....	.....	.....	.....	.....	2.30	1.60	1.70	1.40	1.45
18	.....	.....	.....	.....	.....	.....	.....	2.20	1.60	1.65	1.40	1.45
19	.....	.....	.....	.....	.....	.....	.....	2.20	1.60	1.50	1.40	1.45
20	.....	.....	.....	.....	.....	.....	.....	2.50	1.60	1.50	1.40	1.45
21	.....	.....	.....	.....	.....	.....	.....	2.20	1.60	1.45	1.40	1.45
22	.....	.....	.....	.....	.....	.....	.....	2.20	1.70	1.45	1.40	1.45
23	.....	.....	.....	.....	.....	.....	.....	2.25	1.60	1.45	1.40	1.45
24	.....	.....	.....	.....	.....	.....	.....	2.20	1.60	1.45	1.40	1.45
25	.....	.....	.....	.....	.....	.....	.....	2.15	1.60	1.45	1.40	1.45
26	.....	.....	.....	.....	.....	.....	.....	2.15	1.65	1.45	1.40	1.45
27	.....	.....	.....	.....	.....	.....	.....	2.10	1.60	1.45	1.40	1.40
28	.....	.....	.....	.....	.....	.....	.....	2.05	1.60	1.45	1.40	1.40
29	.....	.....	.....	.....	.....	.....	.....	2.05	1.70	1.45	1.40	1.40
30	.....	.....	.....	.....	.....	.....	.....	2.05	1.65	1.45	1.40	1.40
31	.....	.....	.....	.....	.....	.....	.....	2.00	.....	1.45	.....	1.40
1904.												
1	1.4	1.4	1.6	1.6	2.0	3.2	3.3	3.7	2.1	2.1	1.9	1.5
2	1.4	1.4	1.6	1.6	2.0	3.3	3.3	3.6	2.1	2.2	1.9	1.5
3	1.4	1.4	1.6	1.6	2.0	3.7	3.1	3.5	2.1	2.4	1.8	1.5
4	1.4	1.4	1.6	1.6	2.0	3.8	3.1	3.5	2.1	2.4	1.8	1.45
5	1.4	1.5	1.6	1.6	2.0	3.9	3.2	3.5	2.1	2.4	1.8	1.45
6	1.4	1.5	1.6	1.6	2.0	3.8	3.2	3.6	2.0	2.3	1.85	1.4
7	1.4	1.5	1.6	1.5	2.1	3.7	3.15	3.7	1.95	2.2	1.8	1.4
8	1.4	1.5	1.6	1.6	2.1	3.6	3.1	3.8	1.95	2.2	1.75	1.45
9	1.4	1.5	1.6	1.7	2.1	3.6	3.1	3.7	1.9	2.2	1.7	1.45
10	1.4	1.5	1.6	1.7	2.2	3.6	3.1	3.7	1.9	2.15	1.65	1.5
11	1.4	1.5	1.7	1.7	2.4	3.7	3.0	3.6	1.85	2.15	1.65	1.5
12	1.4	1.5	1.7	1.7	2.5	3.7	2.9	3.2	1.85	2.1	1.6	1.45
13	1.4	1.5	1.7	1.7	2.6	3.8	2.9	3.0	1.85	2.1	1.6	1.45
14	1.4	1.5	1.7	1.7	2.8	3.9	2.9	2.9	1.85	2.05	1.6	1.45
15	1.4	1.5	1.7	1.8	2.8	4.0	2.8	2.9	1.8	2.0	1.6	1.45
16	1.4	1.5	1.7	1.8	2.8	4.1	2.8	2.8	1.8	2.0	1.55	1.5
17	1.4	1.5	1.6	1.8	2.9	4.1	2.8	2.7	1.8	2.0	1.55	1.5
18	1.4	1.5	1.6	1.8	2.9	4.1	2.8	2.7	1.8	1.95	1.5	1.45
19	1.4	1.5	1.6	1.8	2.8	4.1	2.8	2.6	1.8	1.95	1.5	1.4
20	1.4	1.5	1.6	1.7	2.8	4.0	3.0	2.6	1.8	1.95	1.5	1.4
21	1.4	1.5	1.5	1.6	2.9	4.0	3.2	2.6	1.85	1.9	1.5	1.4
22	1.4	1.5	1.5	1.8	2.9	3.9	3.2	2.7	1.85	1.9	1.5	1.4
23	1.4	1.5	1.6	2.1	2.9	3.9	3.1	2.7	1.9	1.95	1.5	1.4
24	1.4	1.5	1.6	2.4	3.0	3.7	3.2	2.6	1.9	1.95	1.5	1.4
25	1.4	1.5	1.9	2.3	3.0	3.7	3.5	2.5	2.0	2.0	1.5	1.4
26	1.4	1.5	1.8	2.3	3.2	3.7	3.5	2.4	1.9	2.0	1.5	1.35
27	1.4	1.5	1.7	2.2	3.1	3.5	3.5	2.5	1.85	2.0	1.5	1.35
28	1.4	1.6	1.8	2.1	3.1	3.4	3.5	2.5	1.9	1.9	1.5	1.4
29	1.4	1.6	1.7	2.0	3.1	3.4	3.5	2.3	2.0	1.85	1.5	1.4
30	1.4	.....	1.6	2.0	3.1	3.4	3.6	2.1	2.1	1.95	1.5	1.4
31	1.4	.....	1.6	.....	3.2	.....	3.7	2.1	.....	1.9	.....	1.4

Rating table for Bishop Creek near Bishop, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	22	2.10	80	2.90	183	3.60	327
1.40	27	2.20	90	3.00	200	3.70	355
1.50	32	2.30	101	3.10	218	3.80	386
1.60	39	2.40	113	3.20	237	3.90	417
1.70	46	2.50	125	3.30	257	4.00	448
1.80	54	2.60	138	3.40	279	4.10	479
1.90	62	2.70	152	3.50	302	4.20	510
2.00	71	2.80	167				

Estimated monthly discharge of Bishop Creek near Bishop, Cal., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
August 11–31	125	71	95.8	3,990
September	71	39	50.5	3,005
October	46	30	38.6	2,373
November	30	27	28.6	1,702
December	30	22	27.3	1,679
The period				12,749
1904.				
January	27	27	27	1,660
February	39	27	31.8	1,829
March	62	32	42	2,582
April	113	32	56.6	3,366
May	237	71	149.3	9,180
June	479	237	372.8	22,183
July	355	167	233	14,327
August	386	80	212	13,035
September	80	54	64	3,808
October	113	58	78	4,796
November	62	32	41	2,440
December	32	24	29	1,783
The year	479	24	111	80,989

RAWSON CANAL NEAR BISHOP, CAL.

This station was established August 7, 1903, by R. S. Hawley. It is located at the county bridge 2½ miles east of Bishop, Cal. The gage is a vertical rod fastened to the bridge from which discharge measurements are made. The gage is read once each day by Paul McDonald. The initial point for soundings is marked on the bridge near the right bank of the canal. The channel is straight for 100 feet above and below the station and the current is swift. The right bank is high and the left bank is low. Neither bank is liable to overflow. The bed of the stream is composed of gravel and is permanent.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Rawson canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
July 31	R. S. Hawley		17.0
August 7	do	1.70	17.6
August 11	do	1.62	13.6
August 17	do	1.85	20.3
August 27	do	1.73	17.1
September 7	do	1.77	18.2
September 14	do	1.81	17.1
October 24	do	1.73	15.4
November 27	do	1.60	13.0
1904.			
February 4	R. S. Hawley	1.66	16.6
February 11	do	2.01	35
April 2	do	1.50	9.4
April 14	do	1.87	27
June 8	do	1.96	24
July 12	J. C. Clausen and L. M. Barnes	1.75	18.8
August 6	L. M. Barnes	1.80	21
August 20	do	2.23	31

Mean daily gage height, in feet, of Rawson canal near Bishop, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	.....	.....	.....	.....	.....	.....	.....	.....	1.74	2.00	1.59	1.65
2	.....	.....	.....	.....	.....	.....	.....	.....	1.72	2.00	1.63	1.64
3	.....	.....	.....	.....	.....	.....	.....	.....	1.76	1.96	1.60	1.70
4	.....	.....	.....	.....	.....	.....	.....	.....	1.73	1.93	1.60	1.71
5	.....	.....	.....	.....	.....	.....	.....	.....	1.74	1.93	1.60	1.70
6	.....	.....	.....	.....	.....	.....	.....	.....	1.80	1.94	1.63	1.35
7	.....	.....	.....	.....	.....	.....	.....	.....	1.79	1.91	1.63	1.35
8	.....	.....	.....	.....	.....	.....	.....	.....	1.80	1.92	1.63	1.43
9	.....	.....	.....	.....	.....	.....	.....	.....	1.76	2.01	1.65	1.35
10	.....	.....	.....	.....	.....	.....	.....	.....	1.78	2.01	1.66	1.30
11	.....	.....	.....	.....	.....	.....	.....	1.60	1.77	1.80	1.65	1.30
12	.....	.....	.....	.....	.....	.....	.....	1.80	1.85	1.75	1.61	1.30
13	.....	.....	.....	.....	.....	.....	.....	1.90	1.90	1.75	1.63	1.39
14	.....	.....	.....	.....	.....	.....	.....	1.90	1.72	1.70	1.60	1.30
15	.....	.....	.....	.....	.....	.....	.....	1.85	1.80	1.70	1.70	1.42
16	.....	.....	.....	.....	.....	.....	.....	1.80	1.85	1.70	1.80	1.44
17	.....	.....	.....	.....	.....	.....	.....	1.85	1.93	1.65	1.92	1.45
18	.....	.....	.....	.....	.....	.....	.....	1.82	1.94	1.65	1.92	1.10
19	.....	.....	.....	.....	.....	.....	.....	1.81	1.99	1.80	1.93	1.10
20	.....	.....	.....	.....	.....	.....	.....	1.86	2.10	1.75	1.90	1.10
21	.....	.....	.....	.....	.....	.....	.....	1.84	2.10	1.70	1.90	1.10
22	.....	.....	.....	.....	.....	.....	.....	1.82	1.94	1.65	1.90	1.20
23	.....	.....	.....	.....	.....	.....	.....	1.81	1.92	1.70	1.91	1.10
24	.....	.....	.....	.....	.....	.....	.....	1.80	1.93	1.73	1.90	1.10
25	.....	.....	.....	.....	.....	.....	.....	1.75	1.94	1.75	1.90	1.10
26	.....	.....	.....	.....	.....	.....	.....	1.74	2.04	1.76	1.90	1.30
27	.....	.....	.....	.....	.....	.....	.....	1.74	2.00	1.77	1.53	1.30
28	.....	.....	.....	.....	.....	.....	.....	1.76	2.00	1.63	1.50	1.30
29	.....	.....	.....	.....	.....	.....	.....	1.73	2.01	1.59	1.51	1.30
30	.....	.....	.....	.....	.....	.....	.....	1.74	2.00	1.59	1.65	1.30
31	.....	.....	.....	.....	.....	.....	.....	1.72	.....	1.59	.....	1.30
1904												
1	[a] 0.00	0.00	1.7	1.5	1.9	2.1	1.9	1.8	2.25	.00	.00	.00
2	.00	.00	1.7	1.5	1.9	1.9	1.9	1.8	2.2	.00	.00	.00
3	.00	1.65	1.7	1.5	1.85	1.9	1.8	1.8	2.1	.00	.00	.00
4	.00	1.65	1.7	1.5	1.85	1.9	1.8	1.8	2.1	.00	.00	.00
5	.00	1.8	1.7	1.5	1.85	[a] .00	1.8	1.8	2.0	.00	.00	.00
6	.00	1.9	1.7	1.5	1.9	.00	1.8	1.8	2.1	.00	.00	.00
7	.00	1.9	1.7	1.5	1.9	.00	1.8	1.8	2.1	.00	.00	.00
8	.00	1.9	1.7	1.5	1.9	2.0	1.8	1.8	2.1	.00	.00	.00
9	.00	1.9	1.7	1.8	1.9	1.9	1.8	1.75	2.0	.00	.00	.00
10	.00	1.9	1.67	1.8	1.85	1.9	1.8	1.75	2.0	.00	.00	.00
11	.00	2.0	1.75	1.9	1.9	1.9	1.75	1.75	2.0	.00	.00	.00
12	.00	2.0	1.75	2.0	1.9	2.0	1.7	1.7	2.0	.00	.00	.00
13	.00	2.1	1.7	2.0	1.9	2.0	1.7	1.7	2.1	.00	.00	.00
14	.00	2.4	1.73	1.9	1.9	2.0	1.65	1.7	2.2	.00	.00	.00
15	.00	2.4	1.7	1.9	2.0	2.0	1.65	1.7	2.1	.00	.00	.00
16	.00	1.85	1.7	1.9	2.0	2.0	1.8	1.75	2.1	.00	.00	.00
17	.00	1.8	1.7	1.65	2.0	2.0	1.8	1.7	2.1	.00	.00	.00
18	.00	1.75	1.7	1.65	2.0	2.0	1.9	1.65	2.2	.00	.00	.00
19	.00	1.75	1.7	1.65	2.0	2.0	1.9	1.9	2.2	.00	.00	.00
20	.00	1.7	1.75	1.85	1.95	2.0	1.9	1.9	2.3	.00	.00	.00
21	.00	1.7	1.7	1.9	2.0	2.0	1.95	2.2	2.3	.00	.00	.00
22	.00	1.8	1.65	1.9	1.9	2.0	1.95	2.2	2.3	.00	.00	.00

[a] Dry, January 1 to February 2; June 5, 6, 7; July 26, 27; September 28 to December 31.

Mean daily gage height, in feet, of Rawson canal near Bishop, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
23	0.00	1.75	1.65	1.9	1.9	2.0	2.2	2.25	2.3	.00	0.00	0.00
24	.00	1.75	1.7	1.9	1.9	1.9	1.4	2.25	2.3	.00	.00	.00
25	.00	1.7	1.7	1.9	1.9	1.9	1.4	2.3	2.3	.00	.00	.00
26	.00	1.75	1.55	1.85	1.9	1.9	*a*.0	2.3	2.3	.00	.00	.00
27	.00	1.7	1.5	1.9	1.9	1.9	.00	2.3	2.4	.00	.00	.00
28	.00	1.7	1.5	1.9	1.9	1.9	1.95	2.3	*a*.00	.00	.00	.00
29	.00	1.7	1.55	1.9	1.9	1.9	1.95	2.3	.00	.00	.00	.00
30	.00	.....	1.55	1.9	1.9	1.9	1.85	2.25	.00	.00	.00	.00
31	.00	.....	1.5	.....	2.0	.....	1.8	2.3	.....	.00	.....	.00

Rating table for Rawson canal near Bishop, Cal., from January 1 to May 31, 1904.

Gage neight.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	1	1.60	14	1.90	29	2.20	48
1.40	5	1.70	18	2.00	35	2.30	55
1.50	9	1.80	23	2.10	41		

Rating table for Rawson canal near Bishop, Cal., from June 1 to September 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.40	5	1.70	16	2.00	26	2.30	37
1.50	9	1.80	19	2.10	30	2.40	40
1.60	12	1.90	23	2.20	33		

Estimated monthly discharge of Rawson canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	59	0	26.2	1,403
March	20	9	16.6	1,018
April	35	9	22.1	1,319
May	35	26	30	1,845
June	27	0	23.1	1,374
July	25	0	20	1,230
August	37	16	26	1,599
September	40	0	29	1,726
The period	.....	.....	.....	11,514

A. O. COLLINS'S CANAL NEAR BISHOP, CAL.

This station was established August 7, 1903, by R. S. Hawley. It is located at the county bridge, 3 miles east of Bishop, Cal. The gage is a vertical rod fastened to the right bank, just above the bridge from which discharge measurements are made. It is read once each day by Paul McDonald. The initial point for soundings is marked on the foot log near the right bank of the canal. The channel is straight for 100 feet above and for 50 feet below the station. The current is sluggish. Both banks are high and are not liable to overflow. The bed of the stream is sandy and shifting.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of A. O. Collins's canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
July 31	R. S. Hawley		12.1
August 7	do	2.2	8.3
August 11	do	2.0	3.9
August 17	do	1.82	2.6
August 27	do	2.1	8.8
September 7	do	2.1	7.9
September 14	do	2.1	7.6
October 23	do	1.65	1.2
1904.			
February 4	R. S. Hawley	1.80	5.2
April 14	do	1.95	7.8
June 8	do	3.67	40
June 12	J. C. Clausen and L. M. Barnes	3.80	28
August 6	L. M. Barnes	3.45	19.8
August 20	do	3.35	14.3
September 6	R. S. Hawley	3.29	17.1
October 10	R. S. Hawley and R. J. Taylor	2.73	4.4
October 14	W. B. Clapp, R. S. Hawley, and R. J. Taylor	2.58	2.8
November 1	R. J. Taylor	2.50	2.1
December 1	do	2.48	1.8

Mean daily gage height, in feet, of A. O. Collins's canal near Bishop, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1	.....	.....	.....	.....	.....	.....	.....	.....	2.06	2.40	1.99	1.60
2	.....	.....	.....	.....	.....	.....	.....	.....	2.10	2.00	1.99	1.52
3	.....	.....	.....	.....	.....	.....	.....	.....	2.10	1.65	2.00	1.60
4	.....	.....	.....	.....	.....	.....	.....	.....	2.10	1.65	2.00	1.65
5	.....	.....	.....	.....	.....	.....	.....	.....	2.01	2.10	2.00	1.60
6	.....	.....	.....	.....	.....	.....	.....	.....	2.01	2.30	2.40	1.90
7	.....	.....	.....	.....	.....	.....	.....	.....	2.01	2.40	2.00	1.85
8	.....	.....	.....	.....	.....	.....	.....	.....	2.01	2.40	2.10	1.90
9	.....	.....	.....	.....	.....	.....	.....	.....	2.01	2.00	2.00	1.90
10	.....	.....	.....	.....	.....	.....	.....	.....	2.02	1.65	2.20	1.82
11	.....	.....	.....	.....	.....	.....	.....	2.00	2.02	1.65	2.10	1.80
12	.....	.....	.....	.....	.....	.....	.....	1.80	2.03	1.65	2.40	1.80
13	.....	.....	.....	.....	.....	.....	.....	1.80	2.07	1.65	2.30	1.60
14	.....	.....	.....	.....	.....	.....	.....	1.80	2.02	1.65	1.50	1.72
15	.....	.....	.....	.....	.....	.....	.....	1.80	2.03	1.65	1.50	1.72
16	.....	.....	.....	.....	.....	.....	.....	1.70	2.04	1.65	1.66	1.90
17	.....	.....	.....	.....	.....	.....	.....	1.82	2.14	1.65	1.80	1.70
18	.....	.....	.....	.....	.....	.....	.....	1.74	2.10	1.65	1.81	2.10
19	.....	.....	.....	.....	.....	.....	.....	2.20	2.07	1.65	1.82	1.70
20	.....	.....	.....	.....	.....	.....	.....	2.12	2.09	1.65	1.80	1.72
21	.....	.....	.....	.....	.....	.....	.....	2.10	2.07	1.65	1.80	1.70
22	.....	.....	.....	.....	.....	.....	.....	2.04	2.20	1.65	1.83	1.73
23	.....	.....	.....	.....	.....	.....	.....	2.10	2.30	1.65	1.60	1.70
24	.....	.....	.....	.....	.....	.....	.....	2.10	2.40	1.65	1.62	1.72
25	.....	.....	.....	.....	.....	.....	.....	2.03	2.50	2.40	1.53	1.70
26	.....	.....	.....	.....	.....	.....	.....	2.03	2.40	2.50	1.51	1.70
27	.....	.....	.....	.....	.....	.....	.....	2.10	2.70	2.40	1.50	1.70
28	.....	.....	.....	.....	.....	.....	.....	2.01	2.40	2.40	1.65	1.70
29	.....	.....	.....	.....	.....	.....	.....	2.10	2.04	2.40	1.51	1.70
30	.....	.....	.....	.....	.....	.....	.....	2.00	2.40	2.06	1.65	1.70
31	.....	.....	.....	.....	.....	.....	.....	2.04	.....	2.09	.....	1.70
1904.												
1	[a] 0.00	0.00	1.80	1.70	1.90	2.20	3.90	3.50	3.25	2.90	2.50	2.50
2	.00	.00	1.80	1.65	1.90	3.00	4.00	3.55	3.20	2.90	2.50	.....
3	.00	.00	1.80	1.65	1.85	3.20	4.00	3.55	3.10	2.90	.....	.....
4	.00	.00	1.80	2.00	1.80	3.40	4.00	3.50	3.10	3.00	.....	.....
5	.00	.00	1.85	2.00	1.80	3.50	4.00	3.50	3.30	3.00	.....	.....
6	.00	.00	1.80	2.00	1.80	3.50	4.00	3.45	3.30	3.10	2.50	.....
7	.00	.00	1.78	2.00	1.80	3.50	3.90	3.45	3.30	3.20	2.50	.....
8	.00	.00	2.00	2.00	1.80	3.60	3.90	3.50	3.30	3.00	.....	.....
9	.00	.00	2.00	2.00	1.80	3.60	3.90	3.50	3.30	2.80	.....	.....
10	.00	.00	2.10	2.00	1.75	3.70	3.90	3.45	3.25	2.80	2.50	.....
11	.00	2.00	2.00	1.80	1.75	3.70	3.90	3.40	3.20	.....	2.50	.....
12	.00	2.60	2.10	2.00	1.80	3.80	3.85	3.40	3.20	2.80	2.50	.....
13	.00	2.60	2.00	1.90	1.95	3.80	3.80	3.35	3.30	2.90	.....	.....
14	.00	2.50	2.00	1.90	1.95	3.90	3.80	3.45	3.30	2.90	2.50	.....
15	.00	2.50	2.00	1.90	3.10	4.00	3.75	3.50	3.20	2.90	2.50	.....
16	.00	2.60	2.00	1.90	3.10	4.00	3.70	3.45	3.20	.....	2.50	.....
17	.00	2.60	2.10	2.10	3.10	4.00	3.70	3.40	3.20	2.80	2.50	.....
18	.00	2.70	2.00	2.00	3.10	4.00	3.60	3.40	3.30	2.80	2.50	.....
19	.00	2.50	1.70	2.00	3.20	4.00	3.60	3.35	3.30	[a] .00	2.50	.....
20	.00	2.60	1.70	2.20	3.20	4.00	3.60	3.30	3.30	.00	.....	.....

[a] Dry: January 1 to February 10; October 19–25.

Mean daily gage height, in feet, of A. O. Collins's canal near Bishop, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
21	0.00	2.25	1.70	2.40	3.20	4.00	3.60	3.30	3.30	0.00	.....	.....
22	.00	2.20	1.70	2.40	3.10	4.00	3.60	3.35	3.30	.00	.....	.....
23	.00	2.10	1.70	2.40	3.20	4.10	3.70	3.30	3.30	.00	.....	.....
24	.00	1.90	1.70	2.40	3.20	4.10	3.65	3.30	3.30	.00	.....	.....
25	.00	1.80	1.70	2.40	1.80	4.10	3.70	3.30	4.00	.00	.....	2.40
26	.00	1.85	1.70	2.10	1.80	4.00	3.70	3.30	3.90	2.50	.....	.....
27	.00	1.80	1.90	2.40	1.80	4.00	3.70	3.30	3.90	2.50	2.50	.....
28	.00	1.80	1.90	2.00	1.80	.....	3.65	3.30	3.00	.....	.....	2.30
29	.00	1.80	1.90	2.10	1.70	4.00	3.50	3.30	3.10	2.50	2.50	.....
30	.00	.....	1.90	2.00	1.70	4.00	3.50	3.30	.....	2.50	2.50	.....
31	.00	.....	1.70	.....	1.60	.....	3.50	3.30	.....	2.50	.....	2.20

Rating table for A. O. Collins's canal near Bishop, Cal., from January 1 to June 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	1	2.20	12	2.90	26	3.50	38
1.60	2	2.30	14	3.00	28	3.60	40
1.70	3	2.40	16	3.10	30	3.70	42
1.80	4	2.50	18	3.20	32	3.80	44
1.90	6	2.60	20	3.30	34	3.90	46
2.00	8	2.70	22	3.40	36	4.00	48
2.10	10	2.80	24				

Rating table for A. O. Collins's canal near Bishop, Cal., from July 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.40	1	2.90	8	3.30	16	3.70	24
2.50	2	3.00	10	3.40	18	3.80	27
2.60	3	3.10	12	3.50	20	3.90	30
2.70	4	3.20	14	3.60	22	4.00	33
2.80	6						

Estimated monthly discharge of A. O. Collins's canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	22	0	12.9	486
March	10	3	5.6	344
April	16	2	9	536
May	32	2	12.8	787
June	50	12	43.1	2,565
July	33	20	26	1,599
August	21	16	18	1,107
September	33	10	16	952
October	14	0	5	307
November	2	2	2	119
December	2	0	[a] 2	123
The period				8,925

[a] Assumed 2 as mean for December.

DELL CANAL NEAR BISHOP, CAL.

This station was established August 24, 1903, by R. S. Hawley. It is located at a flume 3 miles from the head-gate at a point where the canal crosses a slough in Sanders's field. The gage is a vertical rod fastened to the flume. Discharge measurements are made from a bridge across the flume. The observer is F. Sanders. The initial points for soundings is the edge of the flume at the right side. The channel is straight for 150 feet above and for 200 feet below the station. The current is sluggish at all times.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Dell canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 11	R. S. Hawley		24.2
August 20	do		11.0
August 24	do		10.0
August 24	do	0.85	8.0
September 4	do	.78	7.0
September 22	do	1.47	19.6
October 7	do	1.52	19.0

Discharge measurements of Dell canal near Bishop, Cal., in 1903 and 1904—Continued.

Date.	Hyrographer.	Gage height.	Discharge.
1904.		*Feet.*	*Second-feet.*
March 16	R. S. Hawley	1.40	22.0
April 15	do	1.31	17.9
May 28	do	1.60	19.0
June 20	do	1.80	23.0
July 14	J. C. Clausen and L. M. Barnes	1.80	16.9
August 11	L. M. Barnes	1.90	22.0
September 8	R. S. Hawley	1.39	14.5
November 17	R. J. Taylor	1.05	12.0
December 12	do	1.10	11.0

Mean daily gage height, in feet, of Dell canal near Bishop, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1903.											
1									0.79	0.80	0.90
2									.80	.80	.90
3									.80	.81	.90
4									.79		.91
5									.79	.80	.91
6										.80	.92
7									.78	.81	.92
8									.78	.81	
9									.79	.80	.95
10									.80	.80	.94
11									.80		.95
12									.80	.82	.95
13									.80	.82	1.01
14									.79	.83	1.02
15									.79	.83	
16									.80	.83	1.06
17									.80	.84	1.08
18									.78		1.11
19									.78	.84	1.12
20										.85	1.14
21									.79	.86	1.13
22									.80	.86	1.12
23								0.85	.81	.86	1.11
24								.85	.81	.87	1.12
25								.86	.80	.88	1.15
26								.86	.81	.88	1.16
27										.89	1.12
28								.85	.78	.81	(a)
29								.85	.78	.89	
30									.79	.89	
31										.89	

[a] No record obtained from November 27, to December 31, 1903, when the water was turned out.

Mean daily gage height, in feet, of Dell canal near Bishop, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1904.											
1	[a]0.00	0.00	1.40	0.00	1.30	1.60	1.80	1.80	1.90	([b])	.....
2	.00	.00	.....	.00	.....	.....	.....	1.80	.....	.....	.....
3	.00	.00	.....	.00	1.30	1.60	1.80	.....	1.90	.....	.....
4	.00	.00	.....	.00	.....	1.60	.....	1.80	.....	.....	.....
5	.00	.00	.....	.....	1.40	.....	1.80	.....	1.90	.....	.....
6	.00	.00	.....	1.30	.....	1.60	.....	1.80	.....	.....	.....
7	.00	.00	.....	.....	1.30	.....	1.80	.....	1.90	.....	.....
8	.00	.00	.....	1.30	.....	1.60	.....	1.80	.....	.....	.....
9	.00	.00	.....	.....	1.40	.....	1.70	.....	1.90	.....	.....
10	.00	.00	.....	1.40	.....	1.60	.....	1.90	.....	.....	.....
11	.00	.00	.....	1.40	1.50	.....	1.70	.....	.....	.....	.....
12	.00	.00	.....	.....	.....	1.60	.....	1.90	1.90	.....	.....
13	.00	.00	.....	1.30	1.60	.....	1.80	.....	.....	.....	.....
14	.00	.00	.....	.....	.....	1.70	.....	1.90	1.90	.....	.....
15	.00	.00	.....	1.30	1.60	.....	.....	.....	.....	.....	.....
16	.00	.00	1.40	.....	.....	1.80	1.70	1.90	1.90	.....	.....
17	.00	.00	.....	1.30	1.60	.....	.....	.....	.....	.....	.....
18	.00	.00	.....	.....	.....	1.80	1.70	1.90	1.90	.....	.....
19	.00	.00	.....	1.40	1.60	.....	.....	.....	.....	.....	.....
20	.00	.00	.....	.....	.....	1.80	.....	1.90	1.90	.....	.....
21	.00	.00	.....	.....	1.60	.....	1.80	1.90	.....	.....	.....
22	.00	.00	1.40	1.40	.....	1.80	.....	.....	1.90	.....	.....
23	.00	.00	[a].00	.....	1.70	.....	1.80	1.90	.....	.....	.....
24	.00	.00	.00	1.40	.....	1.80	.....	.....	1.90	.....	.....
25	.00	.00	.00	.....	1.70	.....	1.80	1.90	.....	.....	.....
26	.00	.00	.00	1.30	.....	1.80	.....	.....	1.90	.....	.....
27	.00	.00	.00	.....	1.70	.....	1.80	1.90	.....	.....	.....
28	.00	.00	.00	1.30	1.60	1.80	.....	1.90	1.90	.....	.....
29	.00	.00	.00	.....	.....	.....	.....	.....	.....	.....	.....
30	.00	.....	.00	1.30	1.60	1.80	1.80	1.90	1.90	.....	.....
31	.00	.....	.00	.....	.....	.....	.....	.....	.....	.....	.....

[a] Dry: January 1 to February 29; March 23 to April 5.
[b] No record; October 1 to December 31.

Estimated monthly discharge of Dell canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March	21	0	15	922
April	21	0	16	952
May	21	9	15.7	970
June	24	18	21.2	1,304
July	18	15	16.1	984
August	22	18	21	1,291
September	22	22	22	1,309
The period				7,732

NOTE.—Discharge interpolated for missing days. The discharge has been obtained indirectly from measurements.

BIG PINE AND OWENS RIVER CANAL NEAR BISHOP, CAL.

This station was established by J. C. Clausen and R. S. Hawley August 4, 1903. It is located at a footbridge near the house of William Oliver, the observer. It is 7½ miles south and 3 miles east of Bishop, Cal. The gage is a vertical rod securely nailed to the footbridge. Discharge measurements are made from the footbridge. The initial point for soundings is marked on the footbridge near the right bank of the canal. The channel is straight for 600 feet above and for 300 feet below the station. The current is sluggish. Both banks are high and are not liable to overflow. The bed of the stream is sandy and somewhat shifting.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Big Pine and Owens River canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 4	R. S. Hawley	1.60	19.0
August 11	do	1.55	16.3
August 20	do	1.50	17.3
September 14	do	.90	1.3
September 22	do	1.15	4.3
October 27	do	2.29	46.4
1904.			
March 16	R. S. Hawley	2.42	59
May 28	do	2.90	58
June 20	do	3.31	91
July 14	J. C. Clausen and L. M. Barnes	2.40	32
August 11	L. M. Barnes	2.60	29
September 8	R. S. Hawley	1.51	10.6

Mean daily gage height, in feet, of Big Pine and Owens River canal near Bishop, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1									0.90	1.20	2.53	2.35
2									.90	1.25	2.58	2.40
3									.90	1.35	2.53	2.40
4									.90	1.35	2.53	2.40
5								1.55	.90	1.50	2.53	2.30
6								1.50	.90	1.80	2.53	2.30
7								1.63	.90	1.90	2.53	2.30
8								1.62	.90	1.95	2.57	2.30
9								1.80	.90	1.95	2.57	2.35

Mean daily gage height, in feet, of Big Pine and Owens River canal, etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1903.												
10	.....	.....	.....	.....	.....	.....	.....	1.70	0.97	2.03	2.57	2.35
11	.....	.....	.....	.....	.....	.....	.....	1.53	.98	2.22	2.62	2.35
12	.....	.....	.....	.....	.....	.....	.....	1.55	1.00	2.25	2.57	2.35
13	.....	.....	.....	.....	.....	.....	.....	1.40	1.00	2.25	2.57	1.50
14	.....	.....	.....	.....	.....	.....	.....	1.40	1.05	2.27	2.60	1.50
15	.....	.....	.....	.....	.....	.....	.....	1.40	1.05	2.40	2.60	1.50
16	.....	.....	.....	.....	.....	.....	.....	1.60	1.05	2.42	2.55	1.50
17	.....	.....	.....	.....	.....	.....	.....	1.60	1.05	2.45	2.55	1.50
18	.....	.....	.....	.....	.....	.....	.....	1.60	1.10	2.42	2.50	1.52
19	.....	.....	.....	.....	.....	.....	.....	1.60	1.15	2.43	2.50	1.58
20	.....	.....	.....	.....	.....	.....	.....	1.60	1.15	2.45	2.50	1.47
21	.....	.....	.....	.....	.....	.....	.....	1.40	1.12	2.47	2.53	1.48
22	.....	.....	.....	.....	.....	.....	.....	1.40	1.10	2.46	2.53	1.53
23	.....	.....	.....	.....	.....	.....	.....	1.40	1.10	2.30	2.53	1.53
24	.....	.....	.....	.....	.....	.....	.....	1.40	1.10	2.30	2.43	1.47
25	.....	.....	.....	.....	.....	.....	.....	1.35	1.10	2.33	2.41	1.47
26	.....	.....	.....	.....	.....	.....	.....	1.35	1.10	2.32	2.35	1.50
27	.....	.....	.....	.....	.....	.....	.....	1.75	1.12	2.28	2.35	1.50
28	.....	.....	.....	.....	.....	.....	.....	1.75	1.15	2.27	2.35	1.50
29	.....	.....	.....	.....	.....	.....	.....	1.75	1.18	2.25	2.38	1.50
30	.....	.....	.....	.....	.....	.....	.....	1.30	1.22	2.45	[illegible]	1.50
31	.....	.....	.....	.....	.....	.....	.....	.90	.....	2.45	.....	[illegible]
1904.												
1	a0.00	1.95	2.5	1.6	1.7	2.6	2.7	2.6	2.12	2.7	1.45	1.4
2	.00	1.95	2.5	1.45	1.6	2.6	2.7	2.6	2.12	2.65	1.4	1.4
3	1.45	1.96	2.55	1.4	1.6	2.6	2.7	2.6	2.06	2.6	1.4	1.3
4	1.45	1.87	2.55	1.45	1.6	2.9	2.6	2.65	1.8	2.65	1.4	1.4
5	1.45	2.1	2.45	1.0	1.55	3.1	2.6	2.63	1.8	2.65	1.4	1.4
6	1.43	2.0	2.35	1.0	1.5	3.1	2.6	2.55	1.6	1.65	1.4	1.4
7	1.43	2.05	2.35	1.0	1.4	3.1	2.6	2.55	1.55	1.7	1.35	1.3
8	1.43	1.92	2.35	a.00	1.4	3.2	2.6	2.55	1.5	1.6	1.35	1.25
9	1.45	1.83	2.4	.00	1.4	3.1	2.6	2.6	1.5	1.6	1.35	1.2
10	1.45	1.72	2.4	.00	1.4	3.0	2.6	2.65	1.5	1.55	1.35	1.2
11	1.43	1.73	2.75	.00	1.4	3.0	2.5	2.6	1.5	1.55	1.35	1.25
12	1.43	1.86	2.7	.00	1.4	3.0	2.5	2.42	1.45	2.0	1.35	1.2
13	2.0	1.95	2.3	.00	1.45	3.1	2.4	2.42	1.45	1.65	1.35	1.2
14	1.82	2.03	2.3	.00	1.45	3.3	2.4	2.33	1.5	1.55	1.35	1.2
15	1.83	2.03	2.35	1.65	1.55	3.3	2.3	2.3	1.4	1.55	1.35	1.2
16	1.86	2.5	2.5	1.65	1.95	3.4	2.2	2.3	1.45	1.5	1.35	1.2
17	1.87	2.6	2.4	1.6	2.25	3.5	1.6	2.3	1.45	1.5	1.35	1.2
18	1.86	2.03	2.4	1.6	1.7	3.5	1.4	2.3	1.55	1.5	1.35	1.2
19	1.87	1.8	2.4	1.8	2.2	3.4	2.2	2.2	1.6	1.45	1.35	1.2
20	1.8	1.72	2.4	1.8	2.35	3.4	2.2	2.2	1.6	1.45	1.35	1.2
21	1.95	2.33	2.5	1.9	2.2	3.3	2.1	2.2	1.7	1.45	1.4	1.2
22	2.0	2.3	2.3	1.85	2.2	3.3	2.2	2.1	1.7	1.45	1.4	1.2
23	2.0	2.5	2.2	2.05	2.23	3.2	2.3	2.16	1.75	1.45	1.35	1.25
24	2.0	2.7	2.2	1.95	2.5	3.2	2.4	2.16	1.85	1.5	1.35	1.25
25	2.0	2.65	1.8	1.9	2.85	3.1	2.5	2.16	2.75	1.5	1.35	1.25
26	1.9	2.6	1.6	1.9	3.0	3.1	2.5	2.1	3.25	1.5	1.35	1.25
27	1.9	2.66	1.7	1.8	3.0	3.0	2.5	2.16	2.8	1.5	1.35	1.2
28	1.9	2.67	2.0	1.8	2.9	2.9	2.5	2.15	2.7	1.5	1.4	1.2
29	1.9	2.5	2.1	1.8	2.8	2.8	2.5	2.06	2.55	1.5	1.4	1.2
30	1.9	.....	1.9	1.7	2.75	2.8	2.4	2.0	2.75	1.5	1.4	1.2
31	1.9	.....	1.6	.....	2.75	.....	2.4	2.0	.....	1.45	.....	1.3

a Dry: January 1, 2; April 8–14.

Rating table for Big Pine and Owens River canal near Bishop, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	5	1.80	16	2.40	30	3.00	68
1.30	6	1.90	18	2.50	33	3.10	76
1.40	8	2.00	20	2.60	38	3.20	85
1.50	10	2.10	22	2.70	43	3.30	94
1.60	12	2.20	24	2.80	50	3.40	103
1.70	14	2.30	27	2.90	59		

Estimated monthly discharge of Big Pine and Owens River canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	20	0	14	861
February	43	14	24.7	1,421
March	46	12	28	1,722
April	21	3	10	595
May	64	8	23.8	1,466
June	114	38	75.2	4,474
July	43	8	31.2	1,918
August	41	20	29	1,783
September	90	8	21	1,250
October[a]	43	9	16	984
November	9	7	7	416
December	8	5	5.8	357
The year	114	0	23.8	17,247

[a] Head gate shut down October 6. Water flowing after that date is leakage.

SANGER CANAL AT ALVORD, CAL.

This station was established August 4, 1903, by J. C. Clausen and R. S. Hawley. It is located at the county road bridge, one-fourth mile east of the Southern Pacific Railway station at Alvord, Cal. The gage is a vertical rod, fastened to the bridge from which discharge measurements are made. It is read once each day by John Hale. The initial point for soundings is marked on the bridge near the left bank of the canal. The channel is straight for 300 feet above and for 100 feet below the station. The current is sluggish. Both banks are low and liable to overflow. The bed of the stream is shifting.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Sanger canal at Alvord, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 4	R. S. Hawley	2.00	3.1
August 13	do	2.60	10.0
September 8	do	2.45	11.3
September 22	do	2.26	10.1
October 27	do	2.70	14.5
December 4	do	2.30	13.4
1904.			
January 27	R. S. Hawley	1.90	6.6
April 6	do	2.00	9.7
July 14	J. C. Clausen and L. M. Barnes	3.05	10.3
August 11	L. M. Barnes	3.20	15.4
September 8	R. S. Hawley	2.80	7.3
October 9	R. S. Hawley and R. J. Taylor	2.75	14.4
November 17	R. J. Taylor	2.52	15.3
December 9	do	2.30	11.0

Mean daily gage height, in feet, of Sanger canal at Alvord, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.
1903.												
1										2.50	2.60	2.40
2											2.60	
3										2.50	2.60	2.40
4										2.50	2.55	
5											2.50	2.40
6										2.50	2.50	2.40
7											2.50	
8										2.50	2.40	2.30
9											2.40	
10										2.50	4.40	2.30
11										2.20	2.40	
12											2.40	2.30
13										2.50	2.30	2.30
14											2.30	
15										2.50	2.30	2.30
16												
17										2.50	2.30	2.30
18										2.60		
19										2.60	2.40	2.30
20										2.60		2.30
21											2.50	
22										2.60	2.50	2.30

Mean daily gage height, in feet, of Sanger canal at Alvord, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
23	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.60	2.50	2.30
25	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.60	.....	.....
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.50	2.30
27	.....	.....	.....	.....	.....	.....	.....	.....	2.60	2.50	.....	2.30
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.50	2.30
29	.....	.....	.....	.....	.....	.....	.....	.....	2.60	2.50	2.40	2.30
30	.....	.....	.....	.....	.....	.....	.....	.....	2.50	.....	2.40	2.30
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.40	.....	2.30
1904.												
1	2.3	1.9	1.9	1.9	2.7	3.0	3.2	3.4	3.1	2.5	2.6	2.5
2	2.3	.....	1.9	1.9	.....	3.0	3.2	3.4	3.0	2.5	2.6	2.5
3	2.3	2.5	1.9	1.9	2.7	3.0	3.2	3.4	2.9	2.5	2.6	2.5
4	.....	.....	1.9	1.9	.....	3.0	3.2	3.4	2.8	2.5	2.6	(a)
5	1.9	2.5	1.9	1.9	2.7	3.0	3.2	3.4	2.7	2.4	2.6	.....
6	.....	2.5	.....	2.3	.....	3.0	3.2	3.4	2.7	2.4	2.6	.....
7	1.9	2.5	1.9	.....	2.7	3.0	3.2	3.4	2.7	2.4	2.6	.....
8	.....	.....	.....	2.3	2.7	3.2	3.2	3.4	2.7	2.35	2.6	.....
9	1.9	1.9	1.9	2.3	2.7	3.2	3.2	3.4	2.7	2.35	2.6	.....
10	1.9	.....	.....	2.3	2.7	3.2	3.1	3.4	2.7	2.4	2.6	.....
11	.....	1.9	1.9	2.3	2.8	3.2	3.0	3.4	2.7	2.5	2.6	.....
12	1.9	.....	1.9	.....	2.8	3.2	3.0	3.4	2.7	2.6	2.6	.....
13	1.9	1.9	.....	2.5	2.8	3.2	2.9	3.4	2.7	2.6	2.6	.....
14	1.9	1.9	1.9	.....	2.9	3.2	2.9	3.4	2.7	2.6	2.6	.....
15	.....	.....	.....	2.5	2.9	3.2	2.9	3.4	2.7	2.7	2.6	.....
16	1.9	1.9	1.9	2.5	2.9	3.2	2.9	3.4	2.7	2.7	2.6	.....
17	1.9	1.9	2.1	2.5	2.9	3.2	2.9	3.4	2.7	2.7	2.6	.....
18	.....	.....	.....	.....	2.9	3.2	3.0	3.4	2.7	2.7	2.6	.....
19	1.9	1.9	2.1	2.5	2.9	3.2	3.0	3.4	2.7	2.7	2.6	.....
20	.....	1.9	2.1	.....	3.0	3.2	3.0	3.4	2.7	2.7	2.6	.....
21	1.9	1.9	.....	2.5	3.0	3.2	3.2	3.4	2.7	2.7	2.6	.....
22	.....	.....	2.1	.....	3.0	3.2	3.2	3.4	2.7	2.7	2.6	.....
23	1.9	1.9	.....	2.5	3.0	3.2	3.2	3.4	2.7	2.7	2.6	.....
24	1.9	.....	2.1	2.5	.....	3.2	3.3	3.4	2.7	2.7	2.6	.....
25	1.9	1.9	.....	.....	3.0	3.2	3.3	3.4	2.7	2.7	2.6	.....
26	.....	.....	2.1	2.7	3.0	3.2	3.3	3.4	2.7	2.7	2.6	.....
27	1.9	1.9	.....	.....	3.0	3.2	3.3	3.4	2.7	2.7	2.6	.....
28	.....	1.9	.....	2.7	3.0	3.2	3.3	3.4	2.6	2.7	2.6	.....
29	1.9	1.9	1.9	.....	3.0	3.2	3.4	3.4	2.6	2.7	2.6	.....
30	1.9	.....	1.9	2.7	3.0	3.2	3.4	3.4	2.6	2.6	2.6	.....
31	.....	.....	1.9	.....	3.0	.....	3.4	3.4	.....	2.6	.....	.....

a No record for remainder of year.

EAST SIDE CANAL NEAR CITRUS, CAL.

This station was established August 27, 1903, by R. S. Hawley. It is located at the head-gate of the canal. The gage is a vertical rod fastened to the head-gate at which discharge measurements are made. The gage is read once each day by J. Vaughn. At low stages the meter measurements are made by wading at a point below head-gate.

High-stage measurements are made from Southern Pacific Railroad bridge, one-half mile below head-gate.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of East Side canal near Citrus, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 13	R. S. Hawley	1.95	32
August 27	do	2.00	44
September 16	do	1.98	36
October 30	do	2.95	80
December 4	do	3.23	96
1904.			
February 24	R. S. Hawley	1.55	35
April 6	do	1.70	28
May 3	do	1.60	24
June 9	do	2.50	50
July 22	L. M. Barnes	2.50	40
September 12	R. S. Hawley	2.60	42
October 9	R. S. Hawley and R. J. Taylor	2.60	45
November 4	R. J. Taylor	2.30	30
December 2	do	2.25	27

Mean daily gage height, in feet, of East Side canal near Citrus, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1												
2									2.00	2.00	3.00	3.20
3												
4									2.00		3.00	3.20
5										2.20		
6											3.00	(a)
7									2.00	2.30		(a)
8												(a)
9									2.00	2.30	3.00	2.35
10												
11									2.00		3.00	2.40
12										2.40		
13											3.00	
14									1.90	2.50		2.40
15												
16									2.00	2.60	3.00	2.40
17												
18									2.00		3.00	2.00

a Head-gate shut down.

Mean daily gage height, in feet, of East Side canal near Citrus, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
19										2.70		
20											3.00	
21									2.00	2.70		2.00
22												
23									2.00	3.10		2.40
24												
25									2.00		3.05	2.40
26										3.10		
27								2.00			3.15	
28								2.00	2.10	3.00		1.80
29												
30									2.10	2.00	3.15	
31								2.00				
1904.												
1		1.7		1.9			2.6	2.6				
2					1.9				2.6			2.4
3			1.8		1.6	2.4				2.5		
4	1.4			1.8			2.5				2.6	
5								2.6	2.5			2.1
6	1.4					2.4						(a)
7			1.8							2.4	2.5	
8		1.6					2.8	2.6				
9					1.6			b.00	2.6			
10						2.5		.00		2.6		
11	1.1		1.7	1.85			2.8	.00			2.6	
12		1.5						.00	2.6			
13					1.8	2.6		.00				
14	1.4		1.7					.00		2.8	2.5	
15		1.5		1.8			2.6	.00				
16					1.9			.00	2.6			
17						2.6		.00		2.3		
18	1.4	1.8	1.8	1.9			2.8	.00			2.5	
19								.00	2.6			
20	1.4					2.6		.00				
21			1.8					.00		2.4	2.4	
22		1.6					2.5	.00				
23					2.0			.00	2.6			
24						2.5		.00		2.4		
25	1.5		2.1	1.9			2.9	.00			2.5	
26		1.6						.00	2.7			
27					2.4	2.6		.00				
28			1.8					2.0		2.4	2.4	
29	1.6	1.5					2.8	2.4				
30					2.2				2.6			
31										2.5		

a Water shut off for remainder of the year.
b Dry August 9–27.

Rating table for East Side canal near Citrus, Cal., from July 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	3	1.90	18	2.30	32	2.70	48
1.60	7	2.00	21	2.40	36	2.80	52
1.70	11	2.10	25	2.50	40	2.90	55
1.80	14	2.20	28	2.60	44	3.00	59

Estimated monthly discharge of East Side canal near Citrus, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	24	10	18.7	1,150
February	30	21	24.4	1,406
March	39	27	30.3	1,863
April	33	30	31.8	1,892
May	48	24	34	2,091
June	54	48	51.8	3,082
July	55	28	47	2,890
August 1–8, 27–31	44	21	40	1,031
September	48	40	44	2,618
October	52	32	39	2,398
November	44	36	40	2,380
The period				20,909

NOTE.—Discharge interpolated for missing days. From January 1 to June 30 no rating table was made, but discharge was based on measurements indirectly.

STEVENS CANAL NEAR CITRUS, CAL.

This station was established August 27, 1903, by R. S. Hawley. It is located at the waste gate of the canal, 3½ miles north of Citrus, Cal. The gage is a vertical rod fastened to the waste gate. It is read once each day by J. Vaughn. Discharge measurements are made by wading. The initial point for soundings is on the right bank of the canal. The channel is straight for 300 feet above and for 200 feet below the station. The current is sluggish. Both banks are high and are not liable to overflow. The bed of the stream is composed of gravel and earth and is fairly permanent.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Stevens canal near Citrus, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 13	R. S. Hawley		17.7
August 27	do	2.30	23.0
September 16	do	2.40	21.3
1904.			
February 24	R. S. Hawley	2.40	24.0
April 6	do		10.7
May 3	do	2.20	32.0
June 9	do	3.30	38.0
June 24	do	3.87	54.0
July 22	L. M. Barnes	3.20	22.0
September 12	R. S. Hawley	1.70	3.5

Mean daily gage height, in feet, of Stevens canal near Citrus, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.										
1										
2							2.30	2.50		
3										
4							2.30			
5								2.50		
6										
7							2.35	2.50		
8										
9							2.35			
10										
11							2.30			
12										
13										
14							2.60			
15										
16							2.40			
17										
18							2.00			
19										
20										
21							2.40			
22										
23							2.00			
24										
25							2.00			
26										
27						2.30				
28						2.30	2.30			
29										
30							2.35			
31						2.30				

On October 7 the water was turned out.

Mean daily gage height, in feet, of Stevens canal near Citrus, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.										
1	(a)	1.9								
2	(a)				2.2				1.6	
3	(a)							2.5		
4	(a)		2.4						1.5	
5	(a)							2.5		1.5
6	(a)				2.2					
7	(a)		2.2					2.6	1.6	1.5
8	(a)	1.8								
9	(a)				2.0				1.5	1.5
10	(a)							2.5		
11	(a)		2.0						1.5	
12	(a)	1.7						2.5		1.5
13	(a)				2.2					
14	(a)		2.1					2.7	1.6	1.5
15	(a)	1.7								
16	(a)								1.6	1.5
17	(a)			2.2				2.3		
18	(a)		2.6						1.6	
19	(a)							2.4		1.5
20	(a)									
21	(a)						2.6	2.3	1.6	1.5
22	(a)	2.6								
23	(a)				2.3		2.6		1.6	1.5
24	(a)							1.6		
25	(a)		2.9	2.2					1.6	
26	(a)	2.5					2.7	1.5		1.5
27	(a)									
28	(a)						2.5	1.5	1.6	1.5
29	(a)	2.4								
30	1.7						2.5		1.6	1.5
31								1.6		

[a] Dry; January 1–29.

Observer discontinued taking gage height in May on account of high water. Could not cross river.

Rating table for Stevens canal near Citrus, Cal., from January 1 to June 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.40	14	1.70	17	2.00	20	2.30	23
1.50	15	1.80	18	2.10	21	2.40	24
1.60	16	1.90	19	2.20	22		

Rating table for Stevens canal near Citrus, Cal., from July 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	3.0	1.80	4.0	2.10	6	2.40	9
1.60	3.2	1.90	4.5	2.20	7	2.50	10
1.70	3.5	2.00	5.0	2.30	8		

Estimated monthly discharge of Stevens canal near Citrus, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	26	17	20.1	1,156
March	24	20	21.3	1,310
April	22	22	22	1,309
May	23	22	22	1,353
September 21–30	12	10	11	218
October	12	3	8	492
November	3	2	3	178
December	3	3	3	184
The period				6,200

NOTE.—Discharge interpolated for missing days.

OWENS RIVER NEAR CITRUS, CAL.

This station was established October 30, 1903, by R. S. Hawley. It is located at the county bridge 4 miles east of Independence, Cal., and 1 mile from the Southern Pacific Railway station at Citrus, Cal. The station at this point shows the amount of waste water which is discharged into Owens Lake. The gage is a 1 by 4 inch vertical rod nailed to a pile on the upstream side of the middle pier of the bridge. It is read twice each day by Milton Levy. Discharge measurements are made from the county bridge at which the gage is located. The initial point for soundings is the end of the rail at the right end of the bridge. The channel is straight for 200 feet above and for 300 feet below the station. The current has a mean velocity of about 2 feet at ordinary stages. Both banks are high and are not liable to overflow. The bed of the stream is sandy and is liable to shift. The bench mark is a copper tack in the floor beam directly over the gage rod. Its elevation is 1.50 feet above the 12-foot mark of the gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Owens River near Citrus, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
June 27	J. C. Clausen		534
August 28	R. S. Hawley	[a]2.7	8.6
October 30	do	4.4	[a]105
December 4	do	5.0	215
1904.			
January 27	R. S. Hawley	5.45	303
April 6	do	5.30	298
May 3	do	3.65	25
June 9	do	6.65	569
June 24	do	7.20	733
July 22	L. M. Barnes	4.80	176
September 12	R. S. Hawley	4.10	59
October 9	R. S. Hawley and R. J. Taylor	6.30	456
November 4	R. J. Taylor	5.90	410
December 2	do	5.80	351

[a] Corrected gage height and discharge.

Mean daily gage height, in feet, of Owens River near Citrus, Cal., for 1903 and 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1											4.48	4.95
2											4.45	5.0
3											4.65	4.95
4											4.7	5.0
5											4.75	5.0
6											4.7	5.0
7											4.6	5.0
8											4.65	5.03
9											4.7	5.03
10											4.77	5.01
11											4.8	5.0
12											4.83	5.01
13											4.85	5.01
14											4.85	5.2
15											4.87	5.2
16											4.85	5.0
17											4.85	5.2
18											4.85	5.2
19											4.85	5.2
20											4.88	5.2
21											4.95	5.25
22											4.97	5.3
23											4.9	5.3
24											4.95	5.2

Mean daily gage height, in feet, of Owens River near Citrus, Cal., etc.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.0	5.15
26	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.0	5.15
27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.0	5.2
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.0	5.2
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5.0	5.35
30	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.4	5.0	5.35
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	4.47	.....	5.35
1904.												
1	5.35	5.35	5.45	6.15	3.55	5.25	6.6	5.1	4.6	5.75	5.8	5.8
2	5.4	5.3	5.35	5.7	3.6	5.2	6.5	5.4	4.6	5.8	5.7	5.85
3	.....	5.25	5.15	5.55	3.65	5.1	6.45	5.5	4.55	5.7	5.9	(5.85)
4	5.35	5.25	5.3	5.35	3.6	5.0	6.4	5.55	4.6	6.0	5.9	5.9
5	5.4	5.05	5.35	5.25	3.6	5.3	6.35	5.8	4.65	6.0	5.9	5.9
6	5.4	5.05	5.25	5.3	3.55	5.8	6.3	5.7	4.5	6.0	5.85	5.8
7	5.4	5.0	5.15	4.9	3.55	6.2	6.2	5.7	.....	6.0	5.85	5.85
8	5.4	5.0	5.05	4.8	3.5	6.4	6.15	5.6	4.3	6.5	5.9	5.8
9	5.4	5.0	5.05	4.75	3.5	6.5	6.2	5.85	4.25	6.4	5.9	5.85
10	5.45	5.0	4.9	5.5	3.45	6.6	6.2	6.0	4.15	.....	5.85	5.85
11	5.45	5.0	4.95	5.55	3.5	6.5	6.1	6.3	4.05	5.9	5.85	5.8
12	5.4	4.9	5.0	5.4	3.4	6.4	6.1	6.2	4.05	6.1	5.85	5.8
13	5.4	4.85	5.3	5.35	3.45	6.4	6.0	5.9	4.05	6.2	5.8	5.8
14	5.4	4.9	5.1	5.3	3.45	6.4	5.8	5.9	4.1	6.5	5.8	5.8
15	5.4	4.85	5.0	5.2	3.45	6.5	5.65	5.6	4.1	6.5	5.8	5.8
16	5.4	4.9	5.0	5.15	3.4	6.8	5.55	5.65	4.1	6.3	5.85	(5.8)
17	5.4	5.45	5.2	4.15	3.4	6.8	5.4	5.6	4.1	6.4	5.8	(5.8)
18	5.4	5.4	5.25	3.9	3.4	6.8	5.2	5.5	4.1	6.3	5.75	(5.8)
19	5.45	5.7	5.2	3.95	3.8	7.0	5.0	5.55	4.1	6.1	5.8	(5.8)
20	5.4	5.7	5.15	3.9	4.1	7.3	5.0	5.6	4.1	6.0	5.75	(5.8)
21	5.4	5.6	5.2	3.7	4.1	7.3	4.9	5.35	3.85	.....	5.8	(5.75)
22	5.35	5.45	5.2	3.75	4.1	7.3	4.8	5.2	3.75	6.0	5.8	(5.75)
23	5.4	5.5	5.15	3.6	4.5	7.3	4.8	5.15	3.75	6.0	5.8	(5.7)
24	5.4	5.55	5.4	3.55	4.05	7.3	4.7	.....	3.75	6.0	5.8	(5.7)
25	5.45	5.5	6.0	3.5	4.1	7.2	4.8	.....	3.8	6.1	5.85	5.7
26	5.4	5.75	5.95	3.45	4.8	7.2	5.0	.....	4.2	5.9	5.85	5.6
27	5.45	5.5	5.6	3.4	4.9	7.0	4.8	5.1	5.6	5.8	5.8	5.65
28	5.4	5.7	5.8	3.4	5.5	6.8	5.2	.....	5.7	5.9	5.85	(5.65)
29	5.4	5.5	5.95	3.45	5.8	6.8	5.2	.....	5.75	5.9	5.8	(5.65)
30	5.35	.....	6.4	3.4	5.45	6.7	5.3	.....	5.8	5.9	5.8	(5.65)
31	5.4	.....	6.6	.....	5.35	.....	5.1	.....	.....	.....	.....	(5.65)

NOTE.—Gage heights in parenthesis are estimated.

Rating table for Owens River near Citrus, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.60	20	4.60	150	5.60	335	6.60	585
3.70	30	4.70	165	5.70	360	6.70	610
3.80	40	4.80	180	5.80	385	6.80	640
3.90	50	4.90	195	5.90	410	6.90	670
4.00	60	5.00	210	6.00	435	7.00	700
4.10	75	5.10	230	6.10	460	7.10	730
4.20	90	5.20	250	6.20	485	7.20	760
4.30	105	5.30	270	6.30	510	7.30	790
4.40	120	5.40	290	6.40	535	7.40	820
4.50	135	5.50	310	6.50	560		

Estimated monthly discharge of Owens River near Citrus, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	300	280	290.3	17,851
February	372	187	267.5	15,387
March	585	195	289.9	17,823
April	472	2	160.5	9,552
May	385	2	76.8	4,720
June	790	210	572.5	34,064
July	585	165	350	21,521
August	510	230	318	19,553
September	385	35	125	7,438
October	560	360	451	27,731
November	410	360	388	23,088
December	410	335	378	23,242
The year	790	2	306	221,970

POWERS CANAL NEAR BISHOP, CAL.

This station was established August 19, 1903, by R. S. Hawley. It is located one-half mile above mill, on Bishop Creek, and 4½ miles west of Bishop, Cal. The gage is a 1 by 3 inch rod on left bank of canal. Discharge measurements are made by wading. The canal is straight for 20 feet above and 50 feet below the station. The bed of the canal is composed of gravel and is not subject to change. The bench mark is on granite bowlder 60 feet north of penstock of mill pressure pipe. Its elevation is 3.50 feet above the zero of gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Powers canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 10	R. S. Hawley		6.2
August 19	do	1.50	6.8
August 25	do	1.48	6.8
September 3	do	1.33	2.8
September 9	do	1.41	4.9
September 15	do	1.38	3.5
September 21	do	1.36	3.6
1904.			
April 16	R. S. Hawley	1.40	4.4
May 17	do	1.50	6.1
July 12	J. C. Clausen and L. M. Barnes	1.75	16.6
August 6	L. M. Barnes	1.75	15.8
October 24	R. J. Taylor	1.40	3.9

Mean daily gage height, in feet, of Powers canal near Bishop, Cal., for 1904.[a]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	1.3	1.4					17			1.5	1.8		
2				1.5			18		1.4			1.7	1.85
3			1.4				19	1.3		1.5	1.8		
4				1.5			20						
5			1.4			1.8	21				1.8		
6							22			1.5		1.7	
7			1.5				23				1.8		
8		1.4			1.8		24						
9			1.5				25		1.4	1.5	1.8		
10							26						1.85
11			1.5		1.8		27			1.5	1.75	1.7	
12				1.6			28						
13			1.5				29				1.8		
14	1.3			1.6			30						
15					1.8		31	1.3					
16		1.4		1.7									

[a] No record January, February, September, October, November, December.

Rating table for Powers canal near Bishop, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	0	1.50	7	1.70	14	1.90	23
1.30	2	1.60	10	1.80	18	2.00	29
1.40	4						

Estimated monthly discharge of Powers canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March			2	123
April			4	238
May	7	4	6.4	394
June	18	7	12.8	762
July	18	14	16	984
August	20	18	19	1,168
The period				3,669

SOUTH HILLSIDE CANAL NEAR BISHOP, CAL.

This station was established August 26, 1903, by R. S. Hawley. It is located just below the waste gate at head of canal, 5 miles west of Bishop, Cal. The gage is a 1 by 3 inch rod on left bank of canal. The discharge measurements are made by wading. The bench mark is on granite bowlder marked by ring of white paint and located on left bank 2 feet from gage; it is 2.99 feet above zero of gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of South Hillside canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 26	R. S. Hawley	1.8	3.9
September 3	do	1.8	4.2
September 9	do	1.8	4.2
1904.			
February 20	R. S. Hawley	1.60	1.0
April 25	do	2.00	7.0
June 8	do	2.20	10.0
August 27	L. M. Barnes	1.90	5.1
September 7	R. S. Hawley	2.15	10.5
October 15	R. S. Hawley, W. B. Clapp, and R. J. Taylor	1.65	1.0
November 9	R. J. Taylor	1.63	1.1
December 5	do	1.50	.4

Mean daily gage height, in feet, of South Hillside canal near Bishop, Cal., for 1904.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1								
2						1.5		
3					2.0			
4						1.5		
5					2.0			2.1
6								
7					2.0			
8								
9					2.0			
10								
11					2.0		1.9	
12			(b)			1.6		
13					2.0			
14						1.6		
15							1.9	
16						1.7		
17					2.0	1.8		
18							1.9	2.0
19					2.0	1.8		
20		1.6					2.0	
21						1.8		
22					2.0			
23	1.65			(c)		1.8		
24								
25					2.0	1.8		
26								2.0
27					2.0	1.75	2.0	
28								
29						1.8		
30								
31								

[a] No record for September, October, November, and December.
[b] Water turned out March 12 to April 22, inclusive.
[c] Water turned in.

Rating table for South Hillside canal near Bishop, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	0	1.70	2.5	1.90	5.5	2.10	8.5
1.60	1	1.80	4	2.00	7	2.20	10

Estimated monthly discharge of South Hillside canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 24–30	7	7	7	97
May	7	7	7	430
June	4	0	2	119
July	7	4	5.7	350
August	9	7	8	492
The period				1,488

NOTE.—Discharge interpolated for missing days.

NORTH HILLSIDE CANAL NEAR BISHOP, CAL.

This station was established September 3, 1903, by R. S. Hawley. It is located at head gate of the canal, 5 miles west of Bishop, Cal. The gage is a 1 by 3 inch vertical rod fastened to the right side of flume or head gate. Discharge measurements are made from crosspiece of flume on which the distances across are marked at each foot. The initial point for soundings is the end of crosspiece of flume at right bank. The bench mark is on a granite bowlder marked with white paint, and located near gage. It is 2.96 feet above zero of gage.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of North Hillside canal near Bishop, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
August 19	R. S. Hawley		10.6
August 25	do		9.5
September 3	do	1.99	11.2
September 9	do	1.95	11.1
October 26	do	1.77	4.3
1904.			
April 16	R. S. Hawley	1.76	4.6
April 25	do	1.95	10.3
May 17	do	2.00	13.0
June 20	do		13.5
July 12	J. C. Clausen and L. M. Barnes	2.00	13.8
August 8	L. M. Barnes	2.00	15.6
September 7	R. S. Hawley	1.90	9.3
October 15	R. S. Hawley, W. B. Clapp, and R. J. Taylor	1.70	4.4
November 9	R. J. Taylor	1.70	3.8
December 5	do	1.55	1.7

Mean daily gage height, in feet, of North Hillside canal near Bishop, Cal., for 1904.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	[b] 0.00	0.00	0.00	0.00	.....	.....	.....	.....
2	.00	.00	.00	.00	.....	2.05	.....	.....
3	.00	.00	.00	.00	2.05	.....	.....	.....
4	.00	.00	.00	.00	.....	2.05	.....	.....
5	.00	.00	.00	.00	2.05	.....	.....	2.2
6	.00	.00	.00	.00	.....	.....	.....	.....
7	.00	.00	.00	.00	2.05	.....	.....	.....
8	.00	.00	.00	.00	.....	.....	1.9	2.0
9	.00	.00	.00	.00	2.05	.....	.....	.....
10	.00	.00	.00	.00	.....	.....	.....	.....
11	.00	.00	.00	.00	2.05	.....	1.9	.....
12	.00	.00	.00	.00	.....	2.02	.....	.....
13	.00	.00	.00	.00	2.05	.....	.....	.....
14	.00	.00	.00	.00	.....	.....	.....	.....
15	.00	.00	.00	.00	.....	.....	2.0	.....
16	.00	.00	.00	1.76	.....	2.02	.....	.....
17	.00	.00	.00	.....	2.05	.....	.....	.....
18	.00	.00	.00	.....	.....	.....	2.1	2.2
19	.00	.00	.00	.....	2.05	2.0	.....	.....
20	.00	.00	.00	.....	.....	.....	.....	.....
21	.00	.00	.00	.....	.....	1.95	.....	.....
22	.00	.00	.00	.....	2.04	.....	2.1	.....
23	.00	.00	.00	1.95	.....	1.9	.....	.....
24	.00	.00	.00	.....	2.05	.....	.....	.....
25	.00	.00	.00	1.95	.....	1.9	.....	.....
26	.00	.00	.00	.....	.....	.....	.....	2.2
27	.00	.00	.00	.....	2.05	1.9	2.1	.....
28	.00	.00	.00	.....	.....	.....	.....	.....
29	.00	.00	.00	.....	.....	1.9	.....	.....
30	.00	.....	.00	.....	2.03	.....	.....	.....
31	.00	.....	.00	.....	.....	.....	.....	.....

[a] No record for September, October, November, and December. [b] Dry: January 1 to April 15.

Rating table for North Hillside canal near Bishop, Cal., from April 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	3	1.80	6	2.00	11	2.20	21
1.70	4	1.90	8	2.10	15		

Estimated monthly discharge of North Hillside canal near Bishop, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	10	0	3.8	226
May	13	13	13	799
June	13	9	11.2	666
July	15	9	12.1	744
August	21	11	19	1,168
The period	.....	.....	.....	3,603

NOTE.—Discharge interpolated for missing days.

BIG PINE CREEK NEAR BIG PINE, CAL.

This station was established December 5, 1903, by R. S. Hawley. It is located 3 miles southwest of Big Pine, Cal., at a point where the creek leaves the foothills. The gage is a 1 by 3 inch vertical rod fastened to a tree on the left bank of the creek, 3 feet above the footbridge, from which discharge measurements are made. The initial point for soundings is on the footbridge near the right bank, and distances across the stream are marked at intervals of 1 foot. The channel is straight for 30 feet above and 50 feet below the station. The current is swift at all stages. Both banks are high and rocky. The bed of the stream is rough and rocky, and is not subject to much change. Bench mark No. 1 is on a granite bowlder marked by a ring of white paint, 40 feet southeast of the south end of the footbridge. It is 8.54 feet above the zero of the gage. Bench mark No. 2, which is 10.44 feet above the zero of the gage, is marked with a ring of white paint and is located 45 feet southwest of the south end of the footbridge. The gage is read once each day by Mrs. J. M. Randle.

The observations at this station during 1904 have been made under the direction of S. G. Bennett and W. B. Clapp, district hydrographers.

Discharge measurements of Big Pine Creek near Big Pine, Cal., in 1903 and 1904.

Date.	Hydrographer.	Gage height.	Discharge.
1903.		*Feet.*	*Second-feet.*
October 12	R. S. Hawley		16.4
August 14	do		112.4
December 5	do	1.8	8.5
1904.			
January 28	R. S. Hawley	1.80	11.1
February 10	do	1.82	16.5
April 22	do	2.00	22.0
June 4	R. S. Hawley and J. C. Clausen	2.95	105
September 10	R. S. Hawley	2.45	58
October 10	R. S. Hawley and R. J. Taylor	2.00	31
November 18	R. J. Taylor	1.90	21
December 9	do	1.90	20

Mean daily gage height, in feet, of Big Pine Creek near Big Pine, Cal., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.8	1.8	1.9	1.9	1.9	2.9	3.1	3.0	2.5	2.0	2.0	2.0
2	1.8	1.8	1.9	1.9	1.9	3.0	3.1	2.8	2.6	2.0	2.0	1.9
3	1.8	1.8	1.9	1.9	1.9	3.1	3.0	2.8	2.6	2.1	2.0	1.9
4	1.8	1.8	1.9	1.9	2.0	3.0	3.0	2.8	2.5	2.0	2.0	1.9
5	1.8	1.8	1.9	1.9	2.0	3.0	3.0	2.8	2.4	2.1	2.0	1.9
6	1.8	1.8	1.9	1.9	2.1	3.2	3.0	3.0	2.4	2.2	2.0	2.0
7	1.8	1.85	1.9	1.9	2.45	3.1	3.2	3.0	2.5	2.1	2.0	1.95
8	1.8	1.8	1.9	1.95	2.7	3.0	3.2	3.1	2.6	2.1	2.0	1.95
9	1.8	1.8	1.9	1.95	2.7	3.0	3.0	3.5	2.5	2.1	2.0	1.9
10	1.8	1.8	1.8	1.95	2.7	3.1	2.9	3.2	2.5	2.0	2.0	1.9
11	1.8	1.8	1.9	2.0	2.7	3.2	2.9	3.0	2.5	2.0	1.9	1.9
12	1.8	1.8	1.95	2.0	2.8	3.5	2.9	2.9	2.5	2.0	2.0	1.9
13	1.8	1.8	1.9	2.05	2.8	3.5	2.9	2.9	2.5	2.0	2.0	1.85
14	1.8	1.8	1.9	2.1	2.8	3.5	2.9	2.9	2.5	2.0	2.0	1.85
15	1.8	1.8	1.9	2.0	2.8	3.8	2.8	2.9	2.4	2.0	2.0	1.85
16	1.8	2.0	1.9	2.05	2.9	3.8	2.8	2.9	2.4	2.0	2.0	1.85
17	1.8	1.85	1.9	2.0	2.8	3.7	2.8	3.2	2.4	1.9	2.0	1.85
18	1.8	1.8	1.9	2.0	2.9	3.5	2.8	3.0	2.4	1.9	1.9	1.85
19	1.8	1.8	1.9	2.0	2.8	3.5	3.1	3.0	2.3	2.0	1.9	1.85
20	1.8	1.8	1.85	2.0	2.7	3.5	3.3	2.8	2.2	2.0	2.0	1.85
21	1.8	1.8	1.9	2.0	2.6	3.1	3.2	2.8	2.2	2.0	2.0	1.85
22	1.8	1.85	1.9	2.0	2.6	3.0	3.4	2.8	2.2	2.0	1.9	1.85
23	1.8	1.85	1.85	2.0	2.7	3.1	3.5	2.7	2.1	2.1	2.0	1.85
24	1.8	1.85	1.95	2.0	2.9	3.2	3.5	2.7	2.3	2.1	2.0	1.85
25	1.8	1.85	2.0	2.0	3.0	3.1	3.2	2.7	2.2	2.0	2.0	1.85
26	1.8	1.85	1.9	2.0	3.0	3.1	4.0	2.6	2.0	2.0	2.0	1.8
27	1.8	1.85	2.0	2.0	2.8	3.1	3.5	2.6	2.0	2.0	2.0	1.8
28	1.8	1.85	2.0	2.0	2.8	3.1	3.1	2.6	2.0	2.0	2.0	1.8
29	1.8	1.8	2.0	1.9	2.9	3.1	3.0	2.6	2.0	2.1	2.0	1.8
30	1.8	.....	2.0	2.0	2.9	3.1	3.0	2.6	2.0	2.0	2.0	1.85
31	1.8	.....	1.9	.....	2.9	.....	3.0	2.5	.....	2.0	.....	1.9

Rating table for Big Pine Creek near Big Pine, Cal., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.80	11	2.30	45	2.80	90	3.20	127
1.90	16	2.40	53	2.90	100	3.30	136
2.00	22	2.50	62	3.00	109	3.40	145
2.10	29	2.60	71	3.10	118	3.50	154
2.20	36	2.70	81				

Estimated monthly discharge of Big Pine Creek near Big Pine, Cal., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	12	11	11	676
February	22	11	12	690
March	22	11	16.8	1,033
April	29	16	20.5	1,220
May	109	16	72.7	4,469
June	188	100	132	7,855
July	208	90	119	7,317
August	154	62	95.8	5,593
September	71	22	49	2,916
October	36	16	24	1,476
November	22	16	21	1,250
December	22	11	15	922
The year	208	11	49.1	35,417

MISCELLANEOUS MEASUREMENTS IN THE GREAT BASIN.

The following miscellaneous measurements were made in the Great Basin during 1903 and 1904:

Miscellaneous measurements in the Great Basin in 1903 and 1904.

WILLOW CREEK DRAINAGE BASIN IN CALIFORNIA.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1904.				*Sec.-feet.*
January 7	J. S. Evans	Willow Creek	Susanville	11.6
May 12	James Branham	do	do	9
August 16	S. G. Bennett and J. Y. Toler.	do	do	5.4
November 11	James Branham	do	Standish	52

Miscellaneous measurements in the Great Basin in 1903 and 1904—Continued.

OWENS RIVER DRAINAGE BASIN IN CALIFORNIA.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1903.				*Sec.-feet.*
July 30	R. S. Hawley	Hillside canal	At Bishop	3.8
Aug. 5	do	do	do	1.9
Aug. 15	do	do	do	2.3
Sept. 7	do	do	do	2.7
Sept. 15	do	do	do	2.9
Aug. 5	do	Love's ditch	do	.9
Aug. 15	do	do	do	.5
Sept. 5	do	do	do	1.5
Sept. 15	do	do	do	2.4
Oct. 10	do	McGee Creek	do	2.6
Oct. 10	do	Birch Creek	do	5.0
Oct. 12	do	Coyote Creek	do	1.6
Oct. 12	do	Mill Creek	At Big Pine	7.0
Aug. 14	do	Big Pine Creek	do	112
Oct. 12	do	do	do	16.4
Oct. 13	do	Birch Creek	At Fish Springs	3.5
Sept. 21	do	Fish Slough ditch	do	11.2
Oct. 13	do	Tinemaha Creek	do	3.6
Oct. 13	do	Taboose Creek	At Black Rock	4.8
Oct. 13	do	Clear Creek	do	1.7
Oct. 13	do	Goodale Creek	do	6.6
Oct. 13	do	Division Creek	Near Independence	2.5
Oct. 13	do	Oak Creek	do	10.7
Aug. 13	do	IndependenceCreek	At Independence	8.6
Sept. 17	do	do	do	4.5
Oct. 14	do	do	do	4.3
Oct. 14	do	Shepherd Creek	Near Independence	2.1
Oct. 14	do	Moffitt Creek	do	.3
Oct. 14	do	Georges Creek	do	.8
Oct. 15	do	Lone Pine Creek	At Lone Pine	3.3
Oct. 15	do	Tuttle Creek	Near Lone Pine	2.3
Oct. 31	do	Cottonwood Creek	Near Olancha	7.6
Oct. 31	do	Ash Creek	do	1.2
1904.				
Apr. 21	R. S. Hawley	Hillside canal	At Bishop	8.4
July 11	J. C. Clausen	do	do	5.0
Aug. 10	L. M. Barnes	do	do	6.3
Nov. 17	R. J. Taylor	do	do	11.5

Miscellaneous measurements in the Great Basin in 1903 and 1904—Continued.

OWENS RIVER DRAINAGE BASIN IN CALIFORNIA—Continued.

Date.	Hydrographer.	Stream.	Location.	Discharge.
1904.				*Sec.-feet.*
May 14	R. S. Hawley	Love's ditch	At Bishop	5.6
Apr. 21	do	do	do	4.2
July 11	J. C. Clausen	do	do	3.8
Apr. 1	R. S. Hawley	McGee Creek	do	3.8
Apr. 1	do	Birch Creek	do	4.8
Apr. 5	do	do	do	5.0
Apr. 4	do	Coyote Creek	do	2.0
Apr. 4	do	Mill Creek	At Big Pine	5.2
Apr. 5	do	Birch Creek	At Fish Springs	5.0
Apr. 5	do	Tinemaha Creek	do	4.0
Apr. 5	do	Taboose Creek	At Black Rock	4.2
Apr. 5	do	Clear Creek	do	6.4
Apr. 5	do	Goodale Creek	do	2.1
Apr. 5	do	Division Creek	At Black Rock Springs	2.5
Apr. 5	do	Oak Creek	At Independence	9.4
June 24	do	do	do	35
Apr. 5	do	IndependenceCreek	do	3.3
June 24	do	do	do	40
Dec. 19	R. J. Taylor	do	do	3.5
May 4	R. S. Hawley	Shepherd Creek	do	1.0
May 4	do	Georges Creek	do	2.4
May 4	do	Lone Pine Creek	At Lone Pine	4.0
June 10	do	do	do	28
May 5	do	Tuttle Creek	do	3.0
May 5	do	Cottonwood Creek	At Olancha	21
June 10	do	do	do	30
May 5	do	Ash Creek	do	3.0
June 18	J. C. Clausen	North Fork Bishop Creek.	At Bishop	81
Apr. 28	R. S. Hawley	Horton Creek	At Round Valley	5.0
Apr. 12	do	Hughes ditch	At Bishop	1.5
Oct. 1	do	do	do	.3
Oct. 10	do	do	do	3.0
Nov. 3	R. J. Taylor	do	do	2.2
Feb. 20	R. S. Hawley	Indian ditch	do	12.1

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O

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 134.]

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1888. Tenth Annual Report, Part II.
1889. Eleventh Annual Report, Part II.
1890. Twelfth Annual Report, Part II.
1891. Thirteenth Annual Report, Part III.
1892. Fourteenth Annual Report, Part II.
1893. Bulletin No. 131.
1894. Bulletin No. 131; Sixteenth Annual Report, Part II.
1895. Bulletin No. 140.
1896. Water-Supply Paper No. 11; Eighteenth Annual Report, Part IV.
1897. Water-Supply Papers Nos. 15 and 16, Nineteenth Annual Report, Part IV.
1898. Water-Supply Papers Nos. 27 and 28, Twentieth Annual Report, Part IV.
1899. Water-Supply Papers Nos. 35, 36, 37, 38, and 39, Twenty-first Annual Report, Part IV.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65 and 75.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75.
1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.

1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
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AUGUST, 1905.

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DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1904

PREPARED UNDER THE DIRECTION OF F. H. NEWELL

BY

D. W. ROSS, J. T. WHISTLER, and T. A. NOBLE

PART XII.—Columbia River and Puget Sound Drainage.

WASHINGTON

GOVERNMENT PRINTING OFFICE

1905

DUPLICATE

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LETTER OF TRANSMITTAL.

Department of the Interior,
United States Geological Survey,
Hydrographic Branch,
Washington, D. C., May 17, 1905.

Sir: I transmit herewith the manuscript of Part XII of a series of twelve papers which compose the Report of Progress of Stream Measurements for the Calendar Year 1904. Parts I to VI of this report contain the results of the data collected in the territory east of Mississippi River. Parts VII to XII are devoted to the data collected in the territory west of Mississippi River.

The data for this paper were collected under the direction of T. A. Noble, D. W. Ross, and J. T. Whistler. Mr. Noble had charge of the work in Washington, and was assisted by G. H. Bliss, G. F. Harley, and W. G. Steward. Mr. Ross had charge of the work in Idaho and was assisted by Robert Stockton and J. B. Bond. Mr. Whistler had charge of the work in Oregon and was assisted by W. C. Sawyer and J. H. Lewis.

The assembling of the data and the preparation for publication were done under the direction of John C. Hoyt, who has been assisted by R. H. Bolster, Robert Follansbee, Willis E. Hall, G. F. Harley, A. H. Horton, and H. D. Padget.

I request that this manuscript be published as one of the series of water-supply and irrigation papers.

Very respectfully,

F. H. Newell, *Chief Engineer.*

Hon. Charles D. Walcott,
Director United States Geological Survey.

PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1904.

PART XII.

By D. W. Ross, J. T. Whistler, and T. A. Noble.

INTRODUCTION.

The hydrographic work of the United States Geological Survey includes the collection of facts concerning, and the study of conditions affecting, the behavior of water from the time it reaches the earth as rain or snow until it joins the oceans or great navigable rivers. These investigations became a distinct feature of the work of the Survey in the fall of 1888, when an instruction camp was established at Embudo. N. Mex. Since that date the work has been continually and gradually extended as larger funds became available. The first distinctive appropriation for gaging streams was made by the act of August 18, 1894, which contained an item of $12,500 "for gaging the streams and determining the water supply of the United States, including the investigation of underground currents and artesian wells in the arid and semiarid sections." (Digest of Appropriations for 1895, p. 270.)

Since that time a similar act has been passed each year and the appropriations have gradually increased, as shown in the following table:

Annual appropriations for hydrographic surveys.

Year ending June 30, 1895	$12,500
Year ending June 30, 1896	25,000
Year ending June 30, 1897	50,000
Year ending June 30, 1898	50,000
Year ending June 30, 1899	50,000
Year ending June 30, 1900	50,000
Year ending June 30, 1901	100,000
Year ending June 30, 1902	100,000
Year ending June 30, 1903	200,000
Year ending June 30, 1904	200,000
Year ending June 30, 1905	200,000
Year ending June 30, 1906	200,000

The chief feature of the work of the hydrographic division is the systematic study of the flow of the surface waters and the conditions affecting the same. In this connection other information that may be of use to the engineer or others in hydrographic studies, such as river profiles, duration and extent of damage by floods, water-power data, etc., is collected. Furthermore, the work has been so directed that the information collected will be of direct value in the commercial and agricultural development of the country.

As a result of the increased appropriations since June 30, 1902, the work has been largely extended and thoroughly systemized. The various States have been grouped into districts, each of which is under the supervision of a district hydrographer who, with a corps of assistants, devotes his whole time to the study of the hydrographic resources of his district.

The methods used in the collection of these data and in their preparation for publication are given in detail in Water-Supply Paper No. 94. (Hydrographic Manual, U. S. Geol. Survey.)

The general plan of stream gaging which has been developed is to obtain eventually data in regard to the flow of all the important streams in the United States. With this in view, gaging stations are established at points where the data will be of greatest commercial value. At these stations discharge measurements are taken from time to time at typical river stages, and the daily surface fluctuation is obtained by means of gage readings. From these two factors it is possible to estimate both the total flow and its distribution through the period of observation.

The selection of the site for a gaging station and the length of time the station is maintained depend largely upon the needs of each locality. If the stream is to be used for water power, special efforts are made to obtain information concerning the low-water flow. If water is to be stored, the high waters are given special attention. In all sections certain permanent stations are maintained for general statistical purposes to show the conditions which exist through long periods. They also act as primary stations, and are used in connection with short series of measurements to determine the flow in particular portions of the drainage basin.

Gaging stations are divided into two general classes: First, current-meter stations, and second, weir stations. The former class is subdivided as to location into bridge, cable, boat, and wading stations. Fig. 1 shows a cable station with car, tag line, inclined gage, etc. In addition to the bridge, cable, or boat, the equipment of a current-meter gaging station consists in a gage for determining the daily fluctuations of the water surface, bench marks to which the zero of the gage is referred, and permanent marks on the bridge or a tagged line indicating the points of measurement. Where the current is swift

MAP OF THE UNITED STATES, SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1904.

some appliance, generally a secondary cable, is necessary to hold the meter below the surface.

Gaging stations are generally located at bridges, if the channel conditions are satisfactory, as from them the meter can be easily manipulated and the cost of the equipment is comparatively small. The stations are located as far as possible at points where the channel is straight, both above and below the gaging section, and where there are no cross currents, backwater, or boils. The bed of the stream should be as clear as possible from large projections and of a permanent character. The banks should be high, and should overflow at high stages only. At stations with shifting beds more measurements are made, and special methods of computing daily discharges are employed. Great care is taken in the selection and equipment of gaging stations, in order that the data may have the required degree of accuracy.

On many of the larger rivers, where water power is developed by dams, estimates of flow are obtained by observing the head on the

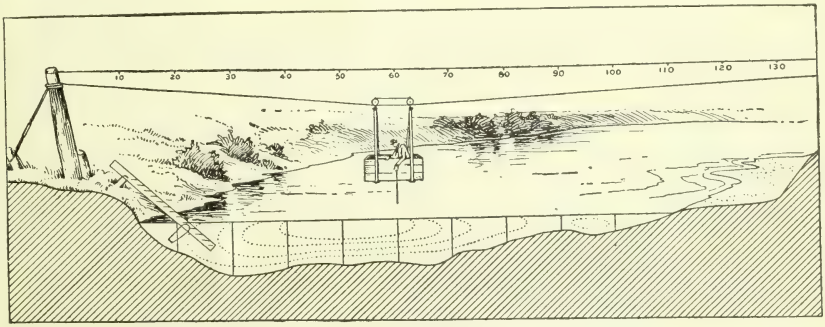


FIG. 1.—Cable station, showing section of river, car, gage, etc.

crest and using a weir formula. On the smaller streams sharp-crested weirs are in some cases erected.

The principal instrument used in stream-measurement work is the current meter, by which the velocity of the flow of water is determined. After years of experience the Survey has adopted the Price current meter for general work. This meter, as is shown on Pl. II, is made in two sizes, known as the large and small Price. The small Price has been largely developed by the officers of the Survey, using the Price acoustic meter as a basis.

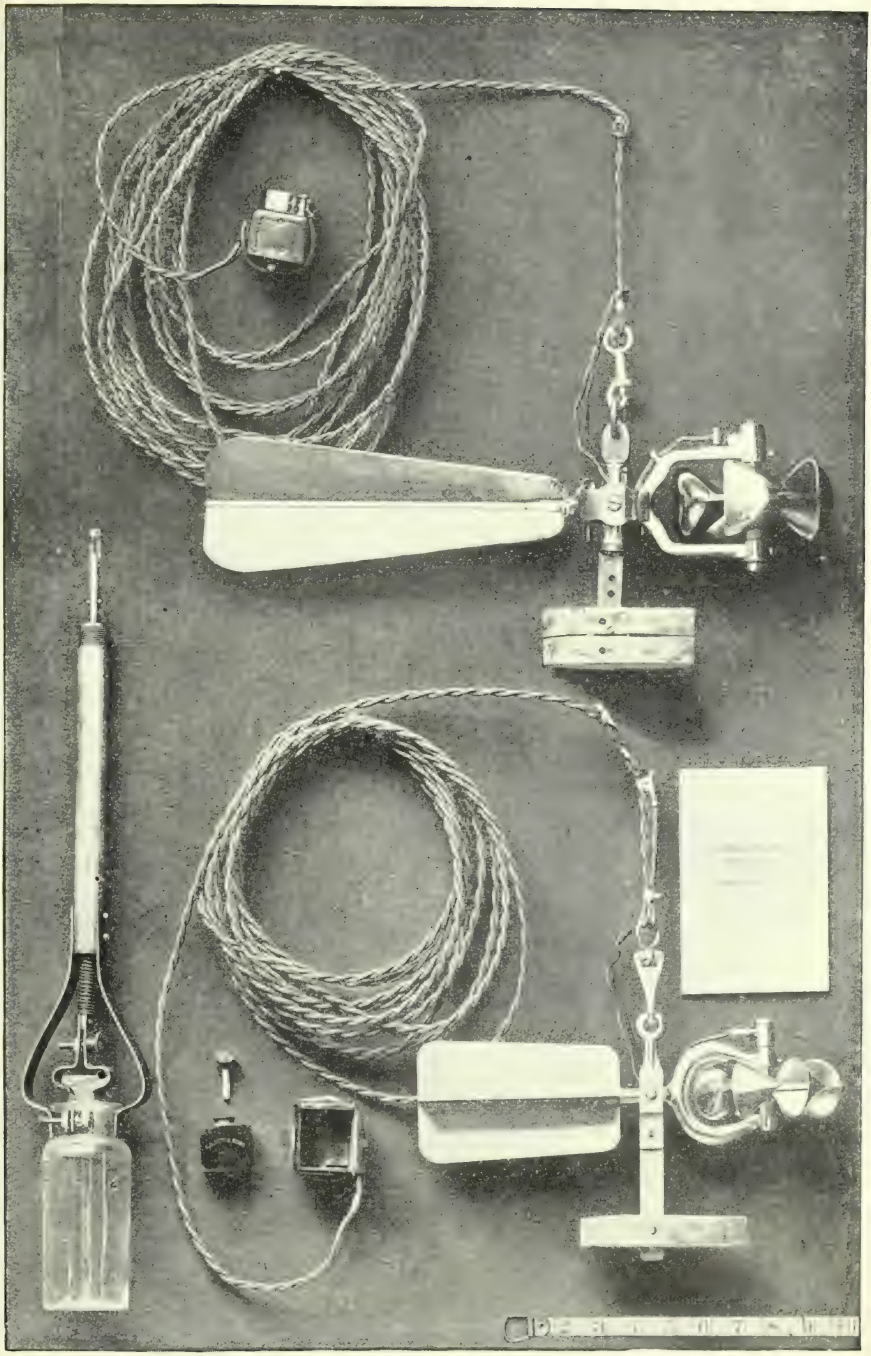
A discharge measurement is the determination of the quantity of water flowing past a certain point at a given time. This quantity is the product of two factors: (1) The mean velocity, which is the function of the cross section, surface slope, wetted perimeter, and roughness of bed; (2) the area, which depends upon the permanency of the bed and the fluctuations of the surface, which govern the depth.

In making the measurement an arbitrary number of points are laid off perpendicular to the thread of the stream (see fig. 1). These points are usually at regular intervals varying from 2 to 20 feet, depending upon the size and conditions of the stream. They are known as measuring points, and at them the observed data, the velocities and soundings, are taken. The perpendiculars dropped from the measuring points divide the gaging section into strips, and for each strip or pair of strips the mean velocity, area, and discharge are determined independently; thus conditions existing in one part of the stream are not distributed to parts where they do not apply.

The methods of obtaining velocity with the current meters which are in general use may be grouped into three classes: Single point, multiple point, and integration.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined. Extensive experiments by vertical velocity-curves show that the thread of mean velocity lies at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and it is at this depth that the meter is held in the majority of the measurements, this being known as the six-tenths depth method. It is found by a large number of vertical velocity-curve measurements, taken on various streams and under various conditions, that the coefficient for reducing the velocity obtained at six-tenths depth to mean velocity is practically unity, ranging, in a series of 910 measurements made at 39 gaging stations, between .94 and 1.04, with a mean for the 910 observations of 1.00. In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the action of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocities taken at the subsurface has been found by repeated experiments with vertical velocity-curves to be from .85 to .95, depending upon the depth of the stream and velocity and channel conditions. This method is specially adapted for flood measurements or when the velocity is so great that the meter can not be kept at 0.6 depth.

The three principal multiple-point methods in general use are: The vertical velocity curve; top and bottom; and top, bottom, and mid depth. In the vertical velocity-curve method a series of velocity determinations are taken in the vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve through these points, the vertical velocity-curve is produced, which shows the change in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the depth



PRICE CURRENT METERS, WITH BUZZERS.

into the area bounded by this mean velocity-curve and the initial line. Owing to the length of time it takes to make these measurements, they are seldom used except for determining coefficients for purposes of comparison and for measurements under ice.

In the second multiple-point method the meter is held from 0.5 to 1 foot below the surface and about 0.5 foot above the bottom, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. This method is not well adapted for general work, as the roughness of the bottom disturbs the velocity at that point. For shallow streams with comparatively smooth beds good results are obtained by this method. In the third multiple-point method the meter is held at mid depth, 0.5 foot below the surface, and 0.5 foot above the bottom, and the mean velocity is determined by dividing the sum of the top velocity, twice the mid-depth velocity, and the bottom velocity by 4.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface. The number of revolutions and the time taken in the operation is noted, and the mean velocity is found by dividing the number of revolutions by the number of seconds taken in the run. This method has the advantage in that the velocity at each point of the vertical is measured twice. It is well adapted for measurements under ice and as a check on the point methods.

The area, which is the other factor for determining the discharge of the stream, depends upon the stage of the river, which is taken on a gage, and the general contour of the bed of the stream, which is found by sounding. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For stations with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also used for obtaining the area for use in high-water measurement computations, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at the various points of measurements the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or double strip. The total discharge and area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The volume of water flowing in a stream is known as run-off. In expressing it various units are used, depending upon the kind of work

for which the data are needed. Those used in this report are "second-feet," "acre-feet," "run-off per square mile," and "run-off in depth in inches," and may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second, and is the body of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second.

The "acre-foot" is the unit of capacity used in connection with storage for irrigation work, and is equivalent to 43,560 cubic feet. It is the quantity required to cover an acre to a depth of 1 foot. There is a convenient relation between the second-foot and the acre-foot; 1 second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, which equals 1.9835 acre-feet, or approximately 2 acre-feet.

The expression "second-feet per square mile" means the number of cubic feet of water flowing each second from every square mile of drainage area on the assumption that the run-off is uniformly distributed.

"Depth in inches" means the depth of water in inches that would have covered the drainage area, uniformly distributed, if all the water could have accumulated on the surface. This quantity is used for comparing run-off with rainfall, which quantity is usually given in depth in inches.

It should be noticed that "acre-feet" and "depth in inches" represent the actual quantities of water which are produced during the periods in question, while "second-feet," on the contrary, is merely a rate of flow, per second.

The base data for computing the daily discharge of a stream are the daily gage heights, and the various discharge measurements of which there should be sufficient number to cover the range of stage. The fundamental laws upon which these computations are based are the following:

(1) The discharge will remain constant so long as the conditions at or near the gaging station remain constant;

(2) Neglecting the change of slope due to the rise and fall of the stream, the discharge will be the same whenever the stream is at a given stage; and

(3) The discharge is both a function of, and increases gradually with, the gage heights. (2 and 3 depend on 1.)

As the beds of many streams are changeable, the problem divides itself into two classes: (1) Those of streams with permanent or practically permanent beds, and (2) those of streams with changeable beds. The base data and methods of obtaining them are the same for either class, and it is only in the computation of the mean daily flow that different methods are necessary.

In determining the daily discharge of streams with permanent beds the results of the discharge measurements are plotted on cross-section

paper, with gage heights as ordinates and discharges as abscissas. Through these points a smooth curve is drawn, which shows the discharge for any gage height, and from which a rating table is prepared. Aside from plotting the discharge, the mean velocity and area determined for each discharge measurement are plotted. Through these points the curves of mean velocity and of area are drawn, and the rating curve is largely determined by taking the product of the mean velocity and the area at various stages as determined by these curves. These curves of mean velocity and area are of special value to determine the location of the rating curve for stages at which actual discharge measurements are not available and for extending the discharge curve outside the limits of the measurements. In the preparation of the rating table the discharge for each tenth or half tenth on the gage is found from the curve. The first and second differences of these discharges are then taken and adjusted according to the law that they shall either be constant or increasing, never decreasing. The discharges in the table are then changed in accordance with these adjusted differences. In making up the station-rating curve the individual discharge measurements and the conditions under which they were taken are carefully studied in order that proper weight shall be given to each measurement. Rating curves in general take the form of a parabola, and as a rule the high-water portion of the curve approaches a straight line. For stations of permanent character the results of the measurements from year to year should be within 5 per cent of the curve, with the exception of those taken during high water, when the probable error may be as high as 10 per cent.

The determination of the daily discharge of streams with changeable beds is difficult, and unless frequent discharge measurements are made the results obtained are only roughly approximate. For streams with continually shifting beds, such as Colorado River and the Rio Grande, discharge measurements are made every two or three days, and the discharges for the intervening days are obtained by interpolation, modified by the gage heights for these days. For stations with beds which shift slowly, or are only materially changed during floods, station-rating curves and tables can be prepared for the periods between changes, and satisfactory results can be obtained with two or three measurements a month, providing measurements are taken soon after the changes take place.

In determining the flow for periods when the streams are frozen, special rating curves and tables have to be prepared from measurements taken under these conditions. The methods of constructing these curves and tables are the same as for open sections. The discharge measurements, however, are either taken by integration in

verticals or by the vertical velocity-curve method, as sufficient experiments have not been made on ice-covered streams to determine the laws which govern the position of the thread of mean velocity.

The Report of Progress of Stream Measurements for the Calendar Year 1904, of which this is Part XII, is published in a series of twelve Water-Supply Papers, Nos. 124–135, inclusive, under the following subtitles:

Part 1. Atlantic coast of New England drainage.

Part 2. Hudson, Passaic, Raritan, and Delaware River drainages.

Part 3. Susquehanna, Patapsco, Potomac, James, Roanoke, Cape Fear, and Yadkin River drainages

Part 4. Santee, Savannah, Ogeechee, Altamaha rivers, and Eastern Gulf of Mexico drainage.

Part 5. Eastern Mississippi River drainage.

Part 6. Great Lakes and St. Lawrence River drainage.

Part 7. Hudson Bay, Minnesota, Wapsipinicon, Iowa, Des Moines, and Missouri River drainages.

Part 8. Platte, Kansas, Meramec, Arkansas, and Red River drainages.

Part 9. Western Gulf of Mexico drainage.

Part 10. Colorado River and Great Basin drainage.

Part 11. The Great Basin and Pacific Ocean drainage in California.

Part 12. Columbia River and Puget Sound drainage.

The territory covered by each paper is given in the subtitle, and the larger drainages are, for convenience in arrangement, subdivided into smaller ones, under which the data are arranged, as far as practicable, geographically.

These papers contain the data that have been collected at the regular gaging stations, the results of the computations based upon the observations, and such other information that has been collected that has a direct bearing on these data, including, as far as practicable, descriptions of the drainage areas and the streams draining them.

For each regular station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of estimated monthly and yearly discharges and run-off.

The descriptions of stations give, as far as possible, such general facts about the locality and equipment as would enable the reader to find the station and use the same. They also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year. This includes the date, the

hydrographer's name, the gage height, and the discharge in second-feet.

The table of daily gage heights gives for each day the mean height of the surface of the river as found from the mean of the gage readings taken on that day. At most of the stations the gage is read in the morning and in the evening.

The rating table gives discharges in second-feet corresponding to each stage of the river as given by the gage heights.

In the table of estimated run-off the column headed "Maximum" gives the mean flow for the day when the mean gage height was the highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest The column headed "Mean" gives the average flow for each second during the month. Upon this mean the computations for the three remaining columns which are defined on page 16 are based.

In the computations for the tables of this report the following general and special rules have been used:

Fundamental rules for computation.

1. The highest degree of precision consistent with the rational use of time and money is imperative.

2. All items of computation should, in general, be expressed by at least two and by not more than four significant figures.

3. Any measurement in a vertical velocity, mean velocity, or discharge curve whose per cent of error is 5 times the average per cent error of all the other measurements should be rejected.

4. In reducing the number of significant figures, or the number of decimal places, by dropping the last figure, the following rules apply:

(a) When the figure in the place to be rejected is less than 5, drop it without changing the preceding figure. Example: 1,827.4 becomes 1,827.

(b) When the figure in the place to be rejected is greater than 5, drop it and increase the preceding figure by 1. Example: 1,827.6 becomes 1,828.

(c) When the figure in the place to be rejected is 5, and it is preceded by an even figure, drop the 5. Example: 1,828.5 becomes 1,828.

(d) When the figure in the place to be rejected is 5, and it is preceded by an odd figure, drop the 5 and increase the preceding figure by 1. Example: 1,827.5 becomes 1,828.

5. In constructing and applying rating tables a maximum limit of one-half per cent error should seldom be exceeded.

Special rules for computation.

1. Rating tables are to be constructed as close as the data upon which they are based will warrant. No decimals are to be used when the discharge is over 50 second-feet.

2. Daily discharges shall be applied directly to the gage heights as they are tabulated.

3. Monthly means are to be carried out to one decimal place when the quantities are below 100 second-feet. Between 100 and 10,000 second-feet, the last figure in the monthly mean shall be a significant figure. This also applies to the yearly mean.

4. Second-feet per square mile and depth in inches for the individual months shall be carried out at least to three significant figures, except in the case of decimals, where the first significant figure is preceded by one or more "0," when the quantity shall be carried out to two significant figures. Example: 1.25; .125; .012; .0012. The yearly means for these quantities are always to be expressed in three significant figures and at least two decimal places.

The results of the stream measurements made during previous years by the United States Geological Survey can be found in the following Survey publications. A detailed index of the reports for years previous to 1904 is given in Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II.
1889. Eleventh Annual Report, Part II.
1890. Twelfth Annual Report, Part II.
1891. Thirteenth Annual Report, Part III.
1892. Fourteenth Annual Report, Part II
1893. Bulletin No. 131.
1894. Bulletin No. 131; Sixteenth Annual Report, Part II.
1895. Bulletin No. 140.
1896. Water-Supply Paper No. 11; Eighteenth Annual Report, Part IV.
1897. Water-Supply Papers Nos. 15 and 16; Nineteenth Annual Report, Part IV.
1898. Water-Supply Papers Nos. 27 and 28; Twentieth Annual Report, Part IV.
1899. Water-Supply Papers Nos. 35 to 39, inclusive; Twenty-first Annual Report, Part IV.
1900. Water-Supply Papers Nos. 47 to 52, inclusive; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65 and 75.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75.
1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124 to 129, inclusive.
West of Mississippi River, Water-Supply Papers Nos. 130 to 135, inclusive.

A limited number of these are for free distribution, and as long as the supply lasts they may be obtained by application to the Director United States Geological Survey or to members of Congress. Other copies are filed with the Superintendent of Public Documents, Washington, D. C., from whom they may be had at prices little above cost. Copies of Government publications are, as a rule, furnished to the public libraries in our large cities, where they may be consulted by those interested.

COOPERATION AND ACKNOWLEDGMENTS.

Most of the measurements presented in this paper have been obtained through local hydrographers. Acknowledgment is extended to other persons and corporations who have assisted local hydrographers or have cooperated in any way, either by furnishing records of the height of water or by assisting in transportation.

The following list, arranged alphabetically by States, gives the names of the resident hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

Idaho.—District engineer, D. W. Ross [a], assisted by Fred Stockton, William G. Davies, and J. B. Bond. Acknowledgments and thanks are due the Oregon Short Line Railroad Company for transportation furnished the district hydrographer and his assistants.

Montana.—District engineer, C. C. Babb [b], assisted by A. E. Place, L. R. Stockman, and Robert Follansbee, assistant engineers, and W. B. Freeman, engineering aid.

Oregon.—District engineer, J. T. Whistler [c], assisted by J. H. Lewis during the first quarter, and by Wilbur C. Sawyer, E. N. Smith, and Ivan Landes the remainder of the year. Acknowledgment and thanks are due the Oregon Railroad and Navigation Company, Southern Pacific Railway Company, Oregon Short Line Railroad Company, Sumpter Valley Railway, and the Columbia Southern Railway for transportation; to the Pacific Live Stock Company, through Mr. Gilchrist, superintendent, for gratuitous gage readings, to W. C. McDonald for the use of his ferry cable on John Day River as a gaging station, and to Mr. J. H. Cunningham, civil and hydraulic engineer, Portland, Oreg., for several miscellaneous current meter measurements.

Washington.—District engineer, T. A. Noble [d], assisted by George H. Bliss, W. G. Steward, and George F. Harley. Acknowledgments and thanks are due to the many owners and managers of irrigation canals in Yakima River Valley for assistance and information furnished in the prosecution of the work in that locality. Acknowledgments are also due to the Washington Irrigation Company, through Walter N. Granger, manager; Northern Pacific Irrigation Company, through O. L. Hanson, superintendent; Washington Water-Power Company, Northern Pacific Railway, Great Northern Railway, and Oregon Railroad and Navigation Company, for assistance and information.

Wyoming.—District hydrographer, M. C Hinderlider [e], and resident hydrographer, A. J. Parshall. Acknowledgments are due for annual passes over all their lines in Wyoming to the Union Pacific Chicago, Burlington and Quincy; Colorado and Southern; Colorado and Wyoming; and Fremont, Elkhorn and Missouri River Valley Railroad Companies.

COLUMBIA RIVER DRAINAGE BASIN.

Next to the Colorado, Columbia River drains the largest area of all rivers in the arid region. Its drainage basin includes parts of Washington, Oregon, Idaho, Montana, and a large area in Canada. No extensive observations of its flow have been made, but the data obtained indicate that the discharge of Columbia River is much greater than that of the Colorado. The Columbia and its numerous tributaries are of great importance, offering good sites for water-power development and an abundance of water for irrigation, while the main river is navigable for a considerable distance.

A great part of the water of Columbia River and its tributaries flows to waste, not being utilized. This is due to the fact that the river has cut so deeply into the lava-covered plains that water can not be diverted except at points near the mountains, where the streams

[a] Office of district engineer, Boise, Idaho.
[b] Office of district engineer, Browning, Mont.
[c] Office of district engineer, Pendleton, Oreg.
[d] Office of district engineer, North Yakima, Wash.
[e] Office of district hydrographer, Chamber of Commerce Building, Denver, Colo

are of small size and have not yet entered the deeply incised canyon in the plateaus. The following rivers are tributary to the Columbia:

Umatilla River rises in the well-wooded country in northeastern Oregon and flows in a general westerly direction, entering Columbia River below the mouth of Walla Walla River. The country north of Umatilla is high and rolling. A number of canals divert water from the lower course of the stream to irrigate lands on either side.

Yakima River has its source in Keechelus Lake, on the eastern slope of the Cascade Mountains, in Kittitas County, Wash. Within a short distance it receives the waters of Kachess Lake, and 2½ miles above Clealum it receives the outlet of the last of the three large head-water lakes. It enters Columbia River 23 miles below Kiona, Wash.

Naches River has its source on the eastern slope of the Cascade Mountains, in Yakima County, Wash. It flows in a general southeasterly direction, entering Yakima River a short distance above North Yakima. Irrigation is practiced in the narrow valley along the lower course of the river, but its waters are of greater value for the irrigation of lands west of North Yakima. The river has considerable fall, and the water can easily be diverted by means of comparatively short canals.

Tieton River is the principal tributary of Naches River and discharges into the latter about 17 miles above its junction with the Yakima River, near North Yakima. Its source is in the Cascade Mountains in the vicinity of Cowlitz Pass. A peculiar feature of the stream is the turbid, milk-white appearance of the water, it being similar in this respect to White River, on the western slope of the Cascade Range. The water of the South Fork of the Tieton, 25 miles above the mouth, is, however, perfectly clear. The forks head in the glaciers of a peak of the Cascades known locally as Goat Rock.

Spokane River rises in the northern part of Idaho, being the outlet of Lake Coeur d'Alene. It passes into Washington, flows in a northerly direction, and enters Columbia River near latitude 47° 52′ north. It is about 120 miles long.

Missoula River has its source in Silverbow County, Mont., and flows northerly until it receives the waters of Little Blackfoot River, when it takes a more northwesterly course. The name Missoula is usually applied to that portion of the river between the junction of Blackfoot and Hellgate rivers and the mouth of Pend Oreille River. From that point to its junction with Columbia River it is called Clark Fork of Columbia.

The source of Bitterroot River is in the high mountains which form the boundary line between Montana and Idaho. It flows in a northerly direction, entering Missoula River a short distance below the city of Missoula. The tributaries on the east side drain comparatively

low hills and contribute little to the supply of the river. The west side branches, on the contrary, are numerous, draining a precipitous and heavily wooded area. Their discharges are regulated by many small lakes fed by banks of snow, which continue far into the summer before disappearing altogether. From Hamilton to Missoula, a distance of 48 miles, the fall of the river is 350 feet, or 7.3 feet to the mile.

Snake River, which is the largest affluent of the Columbia, rises on the southern slope of the Continental Divide in the Yellowstone National Park, draining the country west and southwest of Yellowstone Lake. From Shoshone, Lewis, and Hart lakes, near its head, the river flows in a southerly direction through a timbered and mountainous country, resulting in a long period of high water. After continuing through this area for about 20 miles it broadens into Jackson Lake, a deep body of water about 3 miles wide and 8 miles long. Below the lake the river flows through Jackson Hole Valley—about 40 miles long and 8 miles wide—and then enters a long canyon near the Idaho-Wyoming line. All of the large tributaries come from the east, receiving their waters from the Wind River Range. The west side of the valley is bounded by the high Teton Mountains, from which most of the drainage flows westward through Tieton River into North Fork of Snake River. It empties into Columbia River near Pasco Junction, in the State of Washington.

The headwater tributaries of Palouse River have their sources in western Idaho. After passing into Washington the streams unite to form Palouse River, which has a general southwesterly course, through a rolling country. Six miles below Hooper, Wash., Palouse River bends suddenly to the south and enters its canyon, through which it flows until its junction with Snake River. A short distance above the mouth of the river are the Palouse Falls, approximately 180 feet high.

Weiser River drains Washington County, in the extreme western part of Idaho, and flows into Snake River at Weiser, Idaho.

The Boise drains a mountainous and well-wooded country in Elmore County, Idaho. The effects of the forests are shown in the high flow that is maintained throughout the summer season, in contrast to the discharge of Weiser River, farther to the west, which drains a more barren country. Below the gaging station, which is located in the canyon, a large number of canals divert water to irrigate lands in Boise Valley. The diversion of the water is now so great that frequent complaints of scarcity are heard.

Bruneau River rises in northern Nevada and flows in a general northerly course through southern Idaho, emptying into Snake River at a point south of Boise. Fall River is one of the small tributaries of Snake River at its headwaters in eastern Idaho.

The following rivers in the Columbia drainage basin are also worthy of mention: The Walla Walla, the drainage of which is one of the best irrigated and most productive localities in either Washington or Oregon; Owyhee River, which rises in northwestern Nevada and flows southwest through Idaho; Malheur River, rising in the mountains of east-central Oregon and emptying into Snake River west of Boise; the Grande Ronde, which drains the northern slope of the Blue Mountains and empties into Snake River in southeastern Washington.

The following pages give the results of data collected in Columbia River drainage basin during 1904:

COLUMBIA RIVER NEAR PASCO, WASH.

This station was established October 15, 1904, by C. B. Cox. It is located 1.2 miles from Pasco, Wash., at the bridge of the Northern Pacific Railway Company. A staff gage, in two sections, graduated to feet and tenths, is bolted vertically to the third pier from the east end of the bridge. The lower section is graduated from zero to 10 feet. The upper section is graduated from zero to 20 feet, with its zero at the 10-foot mark of the lower section. Gage readings have been reduced to the zero of the lower section. The gage is read once each day by W. B. Sloan. Discharge measurements are made by means of a boat held from the bridge to which the gage is attached by means of a 400-foot, one-fourth inch rope cable. The meter is lowered 2 feet above the bow of the boat over a roller on a projecting plank and controlled by a windlass. The initial point for soundings is 400 feet below the railway bridge, opposite the center of the east pier. The channel is curved for about 800 feet above and straight for about one-fourth mile below the station. The water above the station is smooth. It becomes swift and rough on the west side of the channel 600 feet below the station. Both banks overflow during high water. The bed of the stream is composed of bowlders and is fairly permanent. There is one channel at high, and two at very low stages. The piers of the bridge, a bar 600 feet below the station, and the movement of the boat affect the measurements. A United States Geological Survey standard aluminum bench-mark tablet marked "350" is placed on the south side of the first pier from the east end of the bridge. Its elevation is 349.78 feet above sea level and 42.03 feet above the gage datum. A United States Coast and Geodetic Survey brass bench-mark tablet on the same pier has an elevation of 44.51 feet above the datum of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurement of Columbia River near Pasco, Wash., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
October 8	C. B. Cox	22,660	2.82	9.90	64,000

Mean daily gage height, in feet, of Columbia River near Pasco, Wash., for 1904.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	8.6	8.7	12	8.4	8.1	23	8.4	8.1
2	8.6	8.6	13	8.3	8.2	24	8.4	8.1
3	8.6	8.5	14	8.3	8.1	25	8.5	8.0
4	8.5	8.5	15	8.3	8.1	26	8.5	7.9
5	8.5	8.4	16	8.3	8.0	27	8.5	7.8
6	8.5	8.4	17	8.3	8.0	28	8.6	7.7
7	8.5	8.3	18	8.3	8.1	29	8.6	7.7
8	8.4	8.2	19	8.3	8.1	30	8.7	7.7
9	8.4	8.1	20	8.3	8.1	31		7.6
10	8.4	8.1	21	8.3	8.1			
11	8.4	8.1	22	8.4	8.1			

KOOTENAI RIVER NEAR BONNERS FERRY, IDAHO.

This station was established May 10, 1904, by W. W. Schlecht. It is located at the Great Northern Railway Company's bridge, three-fourths mile below Bonners Ferry, Idaho, 40 miles above Kootenai Lake, and 5 miles below the mouth of Moyie River. A standard chain gage is securely nailed to floor beams near the first bridge pier from the left bank. The length of the chain from the outer edge of the ring to the lower end of the weight is 43.10 feet. The datum of the gage is 1,727.53 feet above sea level, as determined from the datum of the Great Northern Railway at Bonners Ferry. The gage is read once each day by L. Christenson. Discharge measurements are made from the upstream side of the railroad bridge to which the gage is attached. This consists of three stationary and one draw span and a trestle approach at the left bank. The upstream guard timber along the bridge is marked every 5 feet and numbered every 10 feet; along the trestle the marks and numbers are 25 feet apart. A stay wire, 1,000 feet long, is stretched across the river above the bridge at the time of making each measurement. The stream is considered navigable, and the wire can not be left in position. It is stored with the observer. The initial point for soundings is the mean outer face of the northernmost pier, marked with a 10-penny nail and has zero painted in white on the upstream guard timber. The channel is straight for about 1,000 feet above and 350 feet below the station. About 500 feet below the station there is a sharp curve to the right. The current is sluggish. The right bank is high, wooded, and not

liable to overflow. The left bank is low, wooded, and liable to overflow to the railroad embankment which is about 1,200 feet from the bank proper. The bed of the stream is composed of sand, free from vegetation, and may shift during high water. There are five channels beneath the bridge, and during high water another channel under the trestle at sounding station No. 1750.

Bench mark No. 1 is a point on the sill of the bridge near the right bank at sounding station −52, marked "1770" (datum of the Great Northern Railway), established by a United States and Canadian Boundary Survey party. Its elevation is 42.47 feet above the datum of the gage. Bench mark No. 2 is the top of the head of a 20-penny nail driven horizontally into a signpost about 200 feet northwest of bench mark No. 1, and marked "1771.2." Its elevation is 43.637 feet above the datum of the gage. Bench mark No. 3 is an 8-penny nail driven into the diagonal brace of trestle bent below sounding station 614.3, marked "1761.4." The nail is 10.49 feet below the top of ties on the trestle. Its elevation is 33.87 feet above the datum of the gage. Bench mark No. 4 is on the cap of trestle bent, upstream side, at station 1,850 feet from the initial point for soundings. It was set by a United States and Canadian Boundary Survey party, and marked "1761." Its elevation is 33.74 feet above the datum of the gage.

On account of backwater from Lake Kootenai influencing the gage heights at the Bonners Ferry gage, a gage was set May 18, 1904, on the left bank of the river, about three-fourths mile above James Fitzpatrick's ranch, and 1 mile below the mouth of Moyie River, a large tributary from the north. This gage is about 1 mile above Crossport siding, and 5 miles above Bonners Ferry. The gage is set in two vertical sections connected by levels. The middle section is fastened to a small balm of Gilead tree, and gives the stage of the river between gage heights 20 and 30 feet. The upper section, which is fastened to a large pine stump, gives the stage of the river between gage heights 30 and 38 feet. The gage is read once each day by James Fitzpatrick. The bench mark is the top of a 20-penny nail driven into a telegraph pole near the gage. Its elevation is 37.92 feet above the datum of the gage. River heights from this gage are to be used in making estimates of flow and constructing rating table from the discharge measurements made at Bonners Ferry. At extreme high stages of the lake some backwater will probably influence the gage height, but by going farther up stream the fluctuations due to Moyie River would be omitted, and it is important to include the discharge of the latter.

In order to determine the slope of the river a gage was set May 19, 1904, at Porthill, Idaho, about 300 feet south of the United States-Canada boundary line. A staff gage is fastened vertically to a large cottonwood tree on the right bank. The gage was read once each day by Claude M. Danielson until July 25, 1904, when the gage was

discontinued. The bench mark was two 20-penny nails driven into a tree a few feet north of the depot at Porthill. Its elevation is 35.00 feet above the zero of the gage. The zero of the gage is 1,716.54 feet above sea level, as determined by a United States and Canadian Boundary Survey party from the datum of the Great Northern Railway at Bonners Ferry.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Kootenai River near Bonners Ferry, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage. height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 13	W. W. Schlecht	497	13,880	2.09	17.29	28,950
June 23	C. M. Hurlburt	505	17,020	2.89	[a] 24.00	48,580
September 15	O. Laurguard	447	7,960	1.02	[b] 5.10	8,140

[a] Gage at Crossport 23.85. [b] Gage at Crossport 17.60.

Mean daily gage height, in feet, of Kootenai River near Bonners Ferry, Idaho, for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	22.90	20.80	12.10	6.30	3.30
2	.....	23.00	21.30	11.70	6.30	3.20
3	.....	22.90	21.60	11.30	6.30	3.20
4	.....	22.85	21.80	11.10	6.20	3.20
5	.....	22.80	21.75	10.90	6.10	3.20
6	.....	23.65	21.60	10.70	6.00	3.10
7	.....	24.65	21.50	10.40	5.90	3.10
8	.....	25.30	21.40	10.30	5.80	3.10
9	.....	25.20	21.30	10.20	5.70	3.00
10	17.80	24.90	21.10	10.10	5.70	3.00
11	17.60	24.20	20.70	9.90	5.70	2.90
12	17.40	23.60	20.30	9.70	5.60	2.90
13	17.25	22.80	20.00	9.50	5.50	2.80
14	17.33	22.20	19.60	9.20	5.30	2.80
15	17.80	21.90	19.10	9.00	5.10	2.70
16	17.15	22.20	18.50	8.70	5.00	.....
17	18.40	23.05	17.90	8.50	4.90	.....
18	19.10	23.80	17.30	8.40	4.80	.....
19	20.15	24.40	16.70	8.30	4.60	.....
20	21.25	24.80	16.10	8.20	4.40	.....
21	22.50	24.80	15.40	8.00	4.30	.....
22	24.25	24.40	14.70	7.80	4.20	.....
23	25.40	24.00	14.20	7.60	4.10	.....
24	25.85	23.60	14.00	7.40	4.00	.....
25	25.45	22.80	14.00	7.10	3.90	.....
26	24.50	21.80	13.90	6.90	3.80	.....
27	23.50	21.00	13.30	6.70	3.60	.....
28	23.00	20.50	12.80	6.50	3.50	.....
29	22.80	20.50	12.50	6.40	3.50	.....
30	22.80	20.50	12.50	6.30	3.40	.....
31	22.90	.....	12.50	6.30	.....	.....

Gage readings influenced by backwater.

Mean daily gage height, in feet, of Kootenai River at Crossport, Idaho, for 1904.

Day.	May.	June	July.	Aug.	Sept.	Oct.
1	.....	23.90	23.00	19.30	18.00	16.95
2	.....	23.85	23.60	19.50	18.10	16.92
3	.....	23.80	23.50	19.40	18.00	16.80
4	.....	23.75	.....	19.40	18.00	16.80
5	.....	24.40	23.30	19.50	18.00	16.80
6	.....	25.00	23.10	19.30	17.95	16.90
7	.....	25.70	23.00	19.20	17.95	16.95
8	.....	26.00	23.00	19.20	17.95	17.00
9	.....	25.00	22.80	19.30	17.95	16.90
10	.....	24.40	22.60	19.20	17.90	16.90
11	.....	23.80	22.40	19.10	17.80	16.80
12	.....	23.30	22.10	19.05	17.70	16.75
13	.....	22.90	22.00	19.00	17.70	.....
14	.....	22.80	21.90	18.90	17.65	.....
15	.....	23.00	21.60	18.70	17.60	.....
16	.....	23.60	21.20	18.70	17.50	.....
17	.....	24.00	21.10	18.70	17.50	.....
18	23.25	24.20	20.90	18.65	17.50	.....
19	23.85	25.00	20.70	18.60	17.50	.....
20	24.50	24.80	20.50	18.60	17.40	.....
21	25.30	24.30	20.10	18.50	17.30	.....
22	26.50	24.10	20.05	18.40	17.20	.....
23	27.20	23.85	20.00	18.30	17.15	.....
24	26.80	23.30	20.30	18.20	17.10	.....
25	25.50	22.60	20.20	18.20	17.05	.....
26	24.40	22.20	20.00	18.12	17.03	.....
27	23.60	22.00	19.80	18.10	17.00	.....
28	23.55	22.20	19.75	18.50	17.00	.....
29	23.70	22.40	19.80	18.50	17.00	.....
30	23.80	22.60	19.90	18.00	16.95	.....
31	23.90	.....	19.90	18.00	.....	.....

Mean daily gage height, in feet, of Kootenai River near Porthill, Idaho, for 1904.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1	.....	27.6	26.7	12	.....	28.6	26.5	22	26.6	29.0	23.0
2	.....	27.7	27.0	13	.....	28.3	26.2	23	27.4	28.8	22.7
3	.....	27.6	27.1	14	.....	28.9	26.1	24	27.8	28.7	22.5
4	.....	27.7	27.1	15	.....	28.8	26.0	25	28.1	28.4	[a] 22.3
5	.....	27.8	27.1	16	.....	28.8	25.5	26	28.0	27.9	.....
6	.....	28.1	27.3	17	.....	28.0	25.3	27	27.8	27.5	.....
7	.....	28.6	27.2	18	.....	28.4	24.8	28	27.6	27.1	.....
8	.....	28.8	27.1	19	24.5	28.7	24.6	29	27.5	26.9	.....
9	.....	29.1	27.0	20	25.1	28.9	24.0	30	27.5	26.8	.....
10	.....	29.0	26.9	21	25.5	29.1	23.7	31	27.6	.....	.....
11	.....	28.9	26.7								

[a] Gage discontinued July 25. Gage used only to get the slope of the river.

MISSOULA RIVER AT MISSOULA, MONT.

The original station was established July 10, 1898, by C. C. Babb, and was located at Higgins Avenue Bridge, in Missoula. As the river at this point flows in two channels, originally two gage rods were

attached to the bridge piers, one at each channel, but as fluctuations were found to occur, this location was abandoned and a new one found May 27, 1899, some distance downstream at the bridge of the Bitterroot Valley Division of the Northern Pacific Railway. The river here is practically in one channel, except in times of flood, when some water passes through a slough 600 feet south of the bridge.

The measurements are made from the downstream side of the bridge, the initial point for soundings being over the northeast abutment opposite the center of the first angle block of the truss.

The riprapping around the crib piers of the bridge and remains of old cribs and piling in the channel under the bridge cause eddies which decrease the accuracy of measurements. At flood heights there is a visible difference in the elevation of the water surface above and below the station.

The gage is located on the right bank of the river some 400 feet above the station. It is of the standard chain type, and is attached to a horizontal timber bolted to a cottonwood tree. Timbers above and below and guy wires brace it securely. The length of chain from marker to bottom of weight is 21.89 feet. The elevation of the gage datum is 3,162.18 feet above sea level. The gage is read twice each day by Thomas E. Westby. The bench mark consists of a United States Geological Survey iron post on the north side of Front street, about 200 feet west of McCormick street, and has an elevation of 3,194.64 feet above sea level. The height of the river was read at the three rods during 1899, but all subsequent readings have been made from the new gage above.

The observations at this station during 1904 have been made under the direction of C. C. Babb, district engineer.

Discharge measurements of Missoula River at Missoula, Mont., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
April 28	A. E. Place	365	1,953	6.32	7.48	12,357
May 20	W. B. Freeman	329	1,833	6.25	7.25	11,457
June 22	do	297	1,441	4.54	5.97	6,544
July 10	do	190	952	3.23	4.59	3,071
July 21	do	175	912	2.58	4.04	2,353
August 25	W. B. Freeman and Robert Follansbee.	213	731	1.62	3.04	1.182
November 3	L. R. Stockman		775	1.66	3.12	1,290

Mean daily gage height, in feet, of Missoula River at Missoula, Mont., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	.....	3.20	3.55	7.35	7.35	5.05	3.70	3.32	3.00	3.15	3.15
2	.....	.....	3.15	3.62	7.20	7.48	5.08	3.70	3.20	2.92	3.10	3.15
3	.....	.....	3.18	3.72	7.22	7.38	5.05	3.65	3.15	2.80	3.15	3.10
4	.....	.....	3.15	3.80	7.25	7.20	5.00	3.60	3.12	2.75	3.15	3.10
5	.....	b 3.25	3.15	3.88	7.20	7.00	4.98	3.58	3.10	2.75	3.10	3.05
6	.....	.....	3.15	4.02	7.08	7.00	4.85	3.50	3.05	2.82	3.10	3.03
7	.....	.....	3.18	4.22	7.00	7.02	4.78	3.42	3.10	3.00	3.15	3.00
8	.....	.....	3.20	4.38	6.88	7.00	4.72	3.40	3.10	3.10	3.13	2.85
9	.....	.....	3.22	4.50	6.62	6.92	4.58	3.40	3.08	3.15	3.10	2.93
10	.....	.....	3.20	4.68	6.68	6.90	4.55	3.40	3.00	3.15	3.10	3.12
11	.....	.....	3.18	5.35	6.60	6.80	4.55	3.35	3.00	3.10	3.08	3.08
12	.....	.....	3.10	6.32	6.63	6.48	4.45	3.32	2.98	3.10	3.05	3.10
13	.....	.....	3.12	6.52	6.73	6.38	4.40	3.30	2.97	3.10	3.05	3.12
14	.....	.....	3.15	6.45	6.75	6.28	4.38	3.25	2.98	3.10	3.05	3.00
15	.....	.....	3.18	6.35	6.85	6.20	4.35	3.22	3.00	3.05	3.05	3.05
16	b 3.20	.....	3.25	6.18	6.90	6.30	4.35	3.22	2.95	3.05	3.10	3.10
17	.....	.....	3.32	.....	6.92	6.48	4.32	3.20	2.95	3.10	3.12	3.05
18	.....	.....	3.40	6.28	6.98	6.50	4.35	3.18	2.95	3.15	3.15	3.05
19	.....	.....	3.45	6.45	7.10	6.40	4.28	3.15	2.95	3.35	3.15	3.05
20	.....	.....	3.42	6.58	7.38	6.30	4.20	3.15	2.95	3.28	3.13	3.10
21	.....	.....	3.45	6.70	7.45	6.18	4.08	3.15	2.95	3.18	3.10	3.05
22	.....	3.15	3.40	6.78	7.78	6.00	4.00	3.15	3.00	3.08	3.05	3.05
23	.....	3.18	3.40	6.70	8.60	5.92	3.95	3.15	3.02	3.10	3.05	3.00
24	.....	3.20	3.35	6.60	8.35	5.75	3.95	3.10	3.00	3.10	3.05	b 2.95
25	.....	3.20	(a)	6.50	8.25	5.60	3.90	3.08	2.95	3.12	3.05	(c)
26	.....	3.20	b 2.95	6.60	7.88	5.42	3.88	3.05	2.95	3.15	3.05	.....
27	.....	3.15	.....	6.85	7.50	5.30	3.80	3.02	2.95	3.15	3.05	.....
28	.....	3.15	.....	7.18	7.20	5.22	3.80	3.05	2.92	3.15	3.10	.....
29	.....	3.20	.....	7.42	7.20	5.15	3.80	3.10	2.95	3.15	3.12	.....
30	.....	.....	3.35	7.38	7.22	5.08	3.75	3.32	3.00	3.15	3.15	.....
31	.....	.....	3.48	.....	7.20	.....	3.75	3.40	.....	3.15	.....	b 3.40

a River frozen January 1 to February 22 and also March 25 to 30.
b Readings to top of ice.
c River frozen December 24 to 31.

Rating table for Missoula River at Missoula, Mont., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.80	960	4.00	2,290	5.20	4,140	6.60	8,950
2.90	1,060	4.10	2,420	5.30	4,410	6.80	9,720
3.00	1,160	4.20	2,550	5.40	4,700	7.00	10,490
3.10	1,265	4.30	2,680	5.50	5,000	7.20	11,260
3.20	1,375	4.40	2,810	5.60	5,300	7.40	12,030
3.30	1,485	4.50	2,950	5.70	5,600	7.60	12,800
3.40	1,595	4.60	3,095	5.80	5,910	7.80	13,570
3.50	1,705	4.70	3,245	5.90	6,260	8.00	14,340
3.60	1,815	4.80	3,395	6.00	6,640	8.20	15,110
3.70	1,930	4.90	3,550	6.20	7,410	8.40	15,880
3.80	2,050	5.00	3,720	6.40	8,180	8.60	16,650
3.90	2,170	5.10	3,910				

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904. It is well defined between gage heights 4.00 feet and 7.50 feet. The table has been extended beyond these limits. Above gage height 6.00 feet the rating curve is a tangent, the difference being 385 per tenth.

Estimated monthly discharge of Missoula River at Missoula, Mont., for 1904.

[Drainage area, 5,960 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January			[a] 1,300	79,934	0.218	0.251
February			[a] 1,300	74,777	.218	.235
March [b]	1,705	1,265	1,443	88,726	.242	.279
April	12,030	1,760	6,701	398,737	1.124	1.254
May	16,650	8,950	11,365	698,807	1.907	2.199
June	12,420	3,910	8,161	485,613	1.369	1.527
July	3,910	1,990	2,790	171,550	.468	.540
August	1,930	1,160	1,478	90,879	.248	.286
September	1,485	1,060	1,181	70,274	.198	.221
October	1,540	915	1,241	76,306	.208	.240
November	1,320	1,210	1,263	75,154	.212	.236
December	1,320	1,010	1,204	74,031	.202	.233
The year			3,286	2,384,788	.551	7.501

[a] Estimated.
[b] March 1 to 24 and 30 to 31, inclusive. Mean for 26 days taken as mean for month.

BIG BLACKFOOT RIVER NEAR BONNER, MONT.

This station was established for general information purposes in July, 1898, by C. C. Babb. It is situated a short distance above the junction of the Big Blackfoot with Hellgate River, at the county highway bridge one-half mile west of Bonner and 6 miles east of Missoula. The power dam of the Big Blackfoot Milling Company, about 1,000 yards above the station, interferes with the natural flow of the water, the opening and closing of the gates causing abrupt changes in the gage heights. The channel at the station is straight. Both banks are high and rocky. They are clothed with a vegetation of bushes and single trees. Neither bank is subject to inundation. The bed of the river is rocky and covered with cobbles and bowlders. It is not liable to change. The depth of water varies from 4 to 10 feet. The current is very swift and can seldom be gaged without guying the meter. The discharge measurements are made from the bridge, the distances being marked on the downstream hand rail. The initial point is a notch marked zero at the left end of the downstream hand rail. The gage is attached to the downstream guard rail. It is of the standard chain type and reads to feet and tenths. The marker is a brass-wire index near the handle. The distance from the bottom of the weight to the marker is 20.90 feet. The gage is read twice each day by Charles Anderson.

Bench mark No. 1 is a temporary bench mark of the topographic division of the United States Geological Survey, consisting of a cross cut in the northeast corner of the top of the northeast abutment of the Northern Pacific Railway bridge near Bonner. It has an elevation of 3,290.30 feet above sea level. Bench mark No. 2 is a standard United States Geological Survey iron post located in front of John McCormick's house, at the highway bridge. Its elevation is 3,246.04 feet above sea level. The elevation of the axle of an old gage pulley on the upstream side of the bridge, which serves as a temporary bench mark, is 3,251.68 feet above sea level.

The zero of the gage is 3,230.70 feet above sea level. All elevations refer to Missoula datum—25.34 feet above gage datum.

The observations at this station during 1904 have been made under the direction of C. C. Babb, district engineer.

Discharge measurements of Big Blackfoot River near Bonner, Mont., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Second feet.*
April 30	A. E. Place	134	1,031	6.48	5.10	6,755
May 19	W. B. Freeman	133	949	6.10	4.45	5,793
May 28	W. B. Freeman and E. C. Murphy.	134	950	5.72	4.48	5,431
June 20	W. B. Freeman	133	853	4.77	3.66	4,069
July 9	do	125	652	2.92	2.10	1,901
July 21	do	125	581	2.32	1.59	1,349
August 25	W. B. Freeman and Robert Follansbee.	122	465	1.31	.86	611
November 3	L. R. Stockman	120	465	1.11	.34	516

Mean daily gage height, in feet, of Big Blackfoot River near Bonner, Mont., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.65	0.50	0.40	0.70	5.07	4.51	2.40	1.29	0.83	0.57	0.36	0.31
2	.65	.50	.45	.85	4.97	4.86	2.55	1.29	.83	1.47	.36	.36
3	.70	.45	.60	.85	4.92	4.61	2.55	1.24	.83	.87	.36	.31
4	.75	.45	.55	.95	4.82	4.41	2.55	1.19	.73	.67	.41	.21
5	.75	.60	.55	1.10	4.77	4.36	2.40	1.14	.73	.45	.41	.56
6	.85	.55	.60	1.40	4.67	4.36	2.35	1.09	.73	.22	.36	.56
7	.80	.55	.65	1.65	4.62	4.41	2.25	1.09	.73	.32	.41	.31
8	.70	.50	.75	1.70	4.37	4.21	2.10	1.09	.73	.37	.46	.31
9	.60	.40	1.15	1.90	4.22	4.16	2.05	1.09	.68	.87	.46	.41
10	.60	.55	.90	2.40	4.07	4.21	2.05	1.09	.68	.47	.36	.36
11	.60	.50	.80	3.65	4.22	4.16	2.00	1.09	.....	.47	.21	.26
12	.55	.55	.70	3.65	4.17	3.86	1.95	.99	.63	.47	.31	.26
13	.60	.55	.55	3.70	3.82	3.76	1.85	.99	.63	.47	.31	.31
14	.60	.50	.55	3.85	3.97	3.51	1.85	.99	.63	.47	.31	.26
15	.60	.55	.70	4.05	4.02	3.51	1.75	.99	.58	.37	.41	.31
16	.65	.55	.65	3.80	4.12	3.58	1.72	.96	.60	39	.31	.21
17	.65	.55	.60	3.60	4.24	3.93	1.72	.96	.60	.39	41	.21
18	.65	.45	.60	3.55	4.39	3.83	1.72	.96	.60	.34	.41	.16
19	.55	.40	.60	3.85	4.59	3.83	1.72	.86	.65	.39	.41	.21
20	.65	.40	.65	4.05	4.64	3.63	1.72	.86	.60	.39	3.11	.26
21	.60	.50	.65	4.45	4.84	3.48	1.62	.86	.60	.24	.36	.26
22	.70	.55	.65	4.45	5.39	3.43	1.52	.86	.60	.54	.46	.21
23	.70	.55	.60	4.35	5.59	3.33	1.52	.86	.60	.54	.41	.21
24	.60	.45	.60	4.20	5.79	3.08	1.52	.86	.65	.39	.31	.21
25	.60	.40	.50	4.10	5.54	2.93	1.52	.86	.45	.44	.41	.16
26	.55	.45	.65	4.35	5.19	2.83	1.47	.81	.55	.44	.46	.16
27	.70	.50	.60	4.65	4.69	2.73	1.42	.76	60	.44	.36	(a)
28	.60	.40	.65	4.90	4.54	2.63	1.42	.76	.60	.44	.36	.....
29	.60	.45	.65	5.25	4.49	2.48	1.42	.76	.80	.44	.36	.....
30	.60	.....	.70	5.15	4.54	2.48	1.42	.76	.65	.44	.36	.....
31	.55	.....	.70	.....	4.64	.....	1.32	.81	.....	.44	.....	.....

a Ice, river frozen at gage.

NOTE.—Variations in gage heights due to waste gates of dam above gage.

Rating table for Big Blackfoot River near Bonner, Mont., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.20	440	1.70	1,470	3.20	3,290	4.70	6,180
0.30	480	1.80	1,560	3.30	3,440	4.80	6,420
0.40	525	1.90	1,660	3.40	3,590	4.90	6,660
0.50	575	2.00	1,770	3.50	3,740	5.00	6,900
0.60	635	2.10	1,880	3.60	3,900	5.20	7,380
0.70	705	2.20	1,990	3.70	4,070	5.40	7,860
0.80	775	2.30	2,100	3.80	4,250	5.60	8,340
0.90	845	2.40	2,210	3.90	4,430	5.80	8,820
1.00	915	2.50	2,330	4.00	4,620	6.00	9,300
1.10	985	2.60	2,460	4.10	4,820	6.20	9,780
1.20	1,060	2.70	2,590	4.20	5,030	6.40	10,260
1.30	1,140	2.80	2,730	4.30	5,250	6.60	10,740
1.40	1,220	2.90	2,870	4.40	5,480	6.80	11,220
1.50	1,300	3.00	3,010	4.50	5,710	7.00	11,700
1.60	1,380	3.10	3,150	4.60	5,940		

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1899, 1900, 1903, 1904. It is well defined between gage heights 1.00 foot and 5.00 feet. The table has been extended beyond these limits. Above gage height 5 feet the rating curve is a tangent, the difference being 240 per tenth.

Estimated monthly discharge of Big Blackfoot River near Bonner, Mont., for 1904.

[Drainage area, 2,465 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	810	605	666	40,951	0.270	0.311
February	635	525	574	33,017	.233	.251
March	1,020	525	668	41,074	.271	.312
April	7,500	705	3,785	225,223	1.535	1.713
May	8,820	4,250	6,066	372,984	2.461	2.837
June	6,540	2,330	4,217	250,929	1.711	1.909
July	2,395	1,140	1,638	100,717	.664	.766
August	1,140	740	898	55,216	.364	.420
September	810	550	684	40,701	.277	.309
October	1,260	440	581	35,724	.236	.272
November	550	440	509	30,288	.206	.230
December	610	420	472	29,022	.191	.220
The year	8,820	420	1,730	1,255,846	.702	9.550

BITTERROOT RIVER NEAR GRANTSDALE, MONT.

This station was established April 25, 1902, by H. B. Waters. It is located on the highway bridge 2 miles southwest of Grantsdale and 5 miles southwest of Hamilton, Mont. The gage was originally of the wire type and fastened to the downstream truss of the bridge. It was replaced May 2 by a standard chain gage. The gage is read daily by T. J. Holt, who lives about a quarter of a mile distant.

Two large ditches—the New Hedge and the Republican—are taken out of the river some distance above the station. They irrigate extensive farm lands and orchards in the vicinity of Hamilton.

The length of the chain from the end of the weight to the marker is 23.35 feet. Discharge measurements are made from the highway bridge on the downstream side by the aid of a stay wire. The initial point for sounding is a notch on the hand rail over the northeast bridge pier. The channel is straight both above and below the station.

The stream has a moderate velocity. The right bank has a gentle slope for about 100 feet, when it terminates in a high bank which is not liable to overflow. The left bank is high and is formed above the bridge by a railroad fill. The bed of the stream is composed of gravel and bowlders.

Bench mark No. 1 is a wire nail driven in the northeast side of a large pine stump and marked "B. M. 24.40." The stump is across the road from the west end of the bridge. The elevation above the gage datum is 24.40 feet. Bench mark No. 2 is the northwest bolt in the northwest abutment plate of the bridge. It is marked "B. M. 19.36." Its elevation above the gage datum is 19.36 feet.

The observations at this station during 1904 have been made under the direction of C. C. Babb, district engineer.

Discharge measurements of Bitterroot River near Grantsdale, Mont., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 3	A. E. Place	192	805	5.53	4.60	4,453
May 22	W. B. Freeman	205	1,215	7.69	6.44	9,340
June 21	do	193	891	5.49	4.77	4,894
July 8	do	188	680	3.80	3.66	2,584
July 22	do	180	486	2.55	2.75	1,241
August 26	W. B. Freeman and Robert Follansbee.	159	225	.37	1.37	84
November 4	L. R. Stockman		307	.76	1.70	235

Mean daily gage height, in feet, of Bitterroot River near Grantsdale, Mont., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.00	1.70	1.80	2.10	4.40	5.50	3.95	2.25	1.45	1.20	1.60	1.60
2	2.00	1.70	1.80	2.10	4.50	5.40	3.95	2.15	1.45	1.20	1.60	1.60
3	2.00	1.70	1.80	2.10	4.60	5.30	4.05	2.15	1.35	1.20	1.60	1.60
4	1.90	1.80	1.80	2.20	4.50	5.20	4.05	2.05	1.35	1.20	1.60	1.60
5	1.90	1.80	1.80	2.40	4.50	5.10	3.95	1.95	1.35	1.30	1.60	1.60
6	1.90	1.70	2.00	2.60	4.40	5.40	3.95	1.95	1.35	1.30	1.60	1.60
7	1.80	1.80	2.00	2.60	4.30	5.00	3.85	1.95	1.25	1.40	1.60	1.60
8	1.80	2.10	2.40	2.90	4.30	5.10	3.65	1.85	1.25	1.50	1.50	1.60
9	1.80	2.00	2.50	2.90	4.20	5.20	3.75	1.85	1.25	1.60	1.50	1.60
10	1.80	1.90	2.40	3.50	4.20	5.10	3.65	1.85	1.25	1.60	1.50	1.60
11	1.80	1.90	2.20	3.70	4.30	5.00	3.65	1.75	1.25	1.50	1.50	1.60
12	1.80	1.80	2.10	3.90	4.40	4.60	3.55	1.75	1.25	1.50	1.50	1.60
13	1.80	1.80	2.10	4.20	4.50	4.60	3.35	1.75	1.35	1.50	1.50	1.70
14	1.80	1.80	2.10	4.50	4.60	4.50	3.15	1.75	1.25	1.50	1.50	1.70
15	1.80	1.80	2.10	4.90	4.80	4.90	3.05	1.65	1.25	1.50	1.60	1.70
16	1.80	1.80	2.10	4.60	5.00	5.30	2.95	1.65	1.25	1.50	1.60	1.70
17	1.70	1.90	2.00	4.20	5.10	5.70	2.85	1.55	1.25	1.50	1.60	1.70
18	1.70	1.80	2.00	4.00	5.20	5.40	2.75	1.55	1.25	1.50	1.60	1.70
19	1.70	1.80	2.00	4.00	5.30	5.40	2.75	1.55	1.25	1.50	1.60	1.60
20	1.70	1.70	2.00	4.10	5.40	5.00	2.65	1.45	1.25	1.50	1.60	1.60
21	1.70	1.80	2.10	4.00	5.90	4.80	2.75	1.45	1.25	1.50	1.70	1.60
22	1.70	2.10	2.10	4.00	6.30	4.80	2.75	1.45	1.25	1.50	1.70	1.60
23	1.70	2.00	2.10	3.90	7.00	4.70	2.75	1.35	1.25	1.50	1.70	1.60
24	1.80	1.90	2.00	3.80	7.30	4.40	2.75	1.35	1.35	1.50	1.70	1.60
25	1.80	1.90	2.00	3.70	6.40	4.10	2.65	1.35	1.35	1.50	1.70	1.60
26	1.80	1.90	2.00	3.70	5.80	4.00	2.55	1.35	1.25	1.50	1.70	[a]1.80
27	1.70	1.80	1.90	4.30	5.50	3.90	2.45	1.35	1.25	1.50	1.70	1.80
28	1.80	1.80	1.90	4.80	5.40	4.00	2.45	1.35	1.25	1.50	1.70	1.80
29	1.80	1.80	1.90	4.70	5.40	4.10	2.35	1.45	1.25	1.50	1.70	1.80
30	1.80	.....	2.10	4.70	5.30	4.10	2.35	1.55	1.25	1.50	1.70	1.80
31	1.80	.....	2.10	.....	5.40	.....	2.35	1.45	.....	1.50	.....	1.80

[a] Partial ice gorge below, December 26 to 31.

Rating table for Bitterroot River near Grantsdale, Mont., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.30	75	2.40	820	3.50	2,400	5.20	6,050
1.40	100	2.50	930	3.60	2,560	5.40	6,600
1.50	130	2.60	1,050	3.70	2,720	5.60	7,150
1.60	170	2.70	1,180	3.80	2,890	5.80	7,700
1.70	225	2.80	1,320	3.90	3,060	6.00	8,250
1.80	290	2.90	1,470	4.00	3,240	6.20	8,800
1.90	365	3.00	1,620	4.20	3,620	6.40	9,350
2.00	450	3.10	1,770	4.40	4,030	6.60	9,900
2.10	540	3.20	1,925	4.60	4,480	6.80	10,450
2.20	630	3.30	2,080	4.80	4,970	7.00	11,000
2.30	720	3.40	2,240	5.00	5,500		

The preceding table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904. It is well defined between gage heights 1.30 feet and 6.50 feet. The table has been extended beyond these limits. Above gage height 5.00 feet the rating curve is a tangent, the difference being 275 per tenth.

Estimated monthly discharge of Bitterroot River near Grantsdale, Mont., for 1904.

[Drainage area, 1,550 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	450	225	296	18,200	0.191	0.220
February	540	225	323	18,579	.208	.224
March	930	290	490	30,129	.316	.364
April	5,230	540	2,783	165,600	1.795	2.003
May	11,825	3,620	5,868	360,809	3.786	4.365
June	7,425	3,060	5,208	309,898	3.360	3.749
July	3,335	770	1,899	116,765	1.225	1.412
August	675	88	246	15,126	.159	.183
September	115	65	74	4,403	.048	.054
October	170	55	118	7,256	.076	.088
November	225	130	179	10,651	.115	.128
December [a]	225	170	181	11,129	.117	.135
The year	11,825	55	1,472	1,068,545	.950	12.925

[a] December 26 to 31 estimated on account of ice goge.

BITTERROOT RIVER NEAR MISSOULA, MONT.

This station was established July 6, 1898, by C. C. Babb. The station is located at the Buckhouse wagon bridge, on the main road, 7 miles southwest of Missoula, Mont. As it is not far above its junction with Missoula River, it will give the full discharge of the Bitterroot. The first gage established had a length of wire of 22.83 feet, and the center of the axle of the gage pulley was 3.801 feet below the bench mark. On April 8, 1901, the bridge was washed away, but was immediately replaced. The station was then reestablished with a gage wire of different length. Observations were discontinued November 1, 1901, but were begun again in 1903. The length of the gage wire on October 8, 1903, was found to be 30.40 feet, at which time the center of the gage pulley was 6.70 feet above the United States Geological Survey bench-mark post. The marker on the wire was taken as the end of the wire. April 29, 1904, a standard chain gage replaced the former wire gage. This has a chain length of 25.64 feet. The marker is a brass wire index near its handle. Observations were made during 1904 by Frank Mitchell, Don Buckhouse, and

Frances Coburn. Discharge measurements are made from the downstream guard rail of the wagon bridge to which the gage is attached. The initial point for soundings is a point marked zero over the center of the northeast bridge pier. All distances are marked on the hand rail. The channel is nearly straight above and below the station. The right bank is low and liable to overflow. The left bank is high and rocky and juts out into the river so that the channel is congested at the bridge during floods. The bed of the stream consists of gravel and is shifting. The depth varies from 3 to 6 feet.

The bench mark is a standard United States Geological Survey iron post, set 25 yards northwest of the bridge. Its elevation above gage datum is 19.50 feet, and above sea level (Missoula datum) is 3,140 feet. The center of the old gage pulley has an elevation of 26.20 feet above gage datum. On account of the shifting river bed, which makes accurate rating of the station impossible, this station was abandoned December 31, 1904.

The observations at this station during 1904 have been made under the direction of C. C. Babb, district engineer.

Discharge measurements of Bitterroot River near Missoula, Mont., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 28	A. E. Place	226	2,058	4.20	5.26	8,641
May 20	W. B. Freeman	230	2,082	4.75	6.98	9,883
May 28	Murphy and Freeman	230	2,163	4.81	7.18	10,394
June 20	W. B. Freeman	230	1,926	4.55	6.99	8,761
July 9	do	225	1,431	3.23	4.88	4,626
July 21	do	221	1,091	2.22	3.54	2,422
August 25	Freeman and Follansbee.	207	551	.88	1.32	484
November 3	L. R. Stockman	192	693	.97	1.50	674

Mean daily gage height, in feet, of Bitterroot River near Missoula, Mont., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.05	1.65	1.85	2.45	6.00	7.38	5.66	2.80	1.42	1.20	1.45	1.35
2	2.05	1.65	1.85	2.55	6.10	7.18	5.76	2.70	1.42	1.20	1.45	1.35
3	1.95	1.65	1.85	2.55	6.20	7.28	5.56	2.50	1.42	1.20	1.45	1.30
4	1.85	1.55	1.75	2.75	6.20	7.28	5.46	2.40	1.47	1.20	1.45	1.30
5	1.75	1.55	1.75	2.85	6.00	7.28	5.36	2.30	1.47	1.15	1.45	1.25
6	1.65	1.55	1.85	2.95	5.90	7.38	5.46	2.20	1.47	1.15	1.45	1.20
7	1.65	1.55	3.15	3.05	6.00	7.48	5.46	.....	1.47	1.15	1.40	1.20
8	1.65	1.55	3.55	3.05	5.70	.....	4.96	.....	1.32	1.20	1.40	1.20
9	1.65	1.45	3.95	3.05	5.30	.....	4.96	.....	1.32	1.30	1.40	1.25
10	1.55	1.35	3.25	3.65	5.40	.....	4.86	.....	1.32	1.35	1.40	1.30
11	1.55	1.35	2.95	3.85	5.50	.....	4.71	.....	1.32	1.40	1.40	1.35
12	1.65	1.45	2.75	4.75	5.60	.....	4.61	.....	1.32	1.40	1.40	1.35

Mean daily gage height, in feet, of Bitterroot River near Missoula, Mont., for 1904—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
13	1.75	1.55	2.65	5.25	5.60	.....	4.36	.....	1.22	1.40	1.40	1.35
14	1.85	1.55	2.45	5.65	5.60	.....	3.96	.....	1.22	1.40	1.40	1.40
15	1.85	1.55	2.45	6.35	6.00	.....	3.86	.....	1.22	1.40	1.40	1.40
16	1.85	1.65	2.45	6.35	6.30	.....	3.76	.....	1.12	1.40	1.40	1.40
17	1.75	1.75	2.35	5.85	6.40	.....	3.66	.....	1.12	1.40	1.45	1.35
18	1.75	1.65	2.35	5.55	6.60	.....	3.56	.....	1.12	1.45	1.45	1.35
19	1.65	1.65	2.35	5.55	6.80	.....	3.46	.....	1.12	1.45	1.45	1.35
20	1.65	1.65	2.45	5.55	7.10	6.99	3.46	.....	1.12	1.45	1.45	1.35
21	1.65	1.65	2.55	5.65	7.20	.....	3.46	.....	1.12	1.50	1.50	1.35
22	1.55	1.65	2.75	5.75	7.90	.....	3.46	.....	1.12	1.50	1.50	1.30
23	1.55	1.75	2.45	5.85	8.60	.....	3.46	.....	1.12	1.55	1.55	1.30
24	1.65	2.55	2.25	5.65	9.00	.....	3.40	.....	1.12	1.55	1.55	1.30
25	1.65	2.35	1.95	5.05	9.50	5.78	3.40	1.34	1.12	1.55	1.55	1.30
26	1.65	1.85	1.95	5.15	8.62	5.48	3.20	.....	1.12	1.50	1.50	1.30
27	1.65	1.95	1.95	5.35	7.60	5.18	3.20	.....	1.12	1.50	1.50	1.30
28	1.55	1.85	2.05	5.85	7.20	5.18	3.10	1.84	1.12	1.50	1.45	1.35
29	1.55	1.85	2.25	6.80	7.10	5.28	3.00	1.84	1.12	1.50	1.45	1.40
30	1.65	.....	2.45	6.60	7.30	5.48	2.90	1.89	1.17	1.50	1.40	1.45
31	1.65	.....	2.45	.....	7.50	.....	3.00	1.89	.....	1.45	.....	1.50

Rating table for Bitterroot River near Missoula, Mont., from January 1 to December 31, 1904.

Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.10	370	2.70	1,670	4.30	3,520	6.60	8,460
1.20	440	2.80	1,770	4.40	3,660	6.80	9,140
1.30	510	2.90	1,870	4.50	3,810	7.00	9,820
1.40	580	3.00	1,970	4.60	3,960	7.20	10,500
1.50	650	3.10	2,070	4.70	4,110	7.40	11,180
1.60	720	3.20	2,180	4.80	4,260	7.60	11,860
1.70	790	3.30	2,290	4.90	4,420	7.80	12,540
1.80	870	3.40	2,400	5.00	4,580	8.00	13,220
1.90	950	3.50	2,520	5.20	4,940	8.20	13,900
2.00	1,030	3.60	2,640	5.40	5,340	8.40	14,580
2.10	1,120	3.70	2,760	5.60	5,740	8.60	15,260
2.20	1,210	3.80	2,880	5.80	6,160	8.80	15,940
2.30	1,300	3.90	3,000	6.00	6,620	9.00	16,620
2.40	1,390	4.00	3,120	6.20	7,160	9.20	17,300
2.50	1,480	4.10	3,250	6.40	7,780	9.40	17,980
2.60	1,570	4.20	3,380				

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is fairly defined between gage heights 1.30 feet and 7.20 feet. The table has been extended beyond these limits. Above gage height 6.40 feet the rating curve is a tangent, the difference being 340 per tenth. There is some uncertainty in the curve due to shifting channel.

Estimated monthly discharge of Bitterroot River near Missoula, Mont.

[Drainage area, 3,260 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	1,075	685	799	49,129	0.245	0.282
February	1,525	545	788	45,326	.242	.261
March	3,060	830	1,434	88,173	.440	.507
April	9,140	1,435	4,592	273,243	1.409	1.572
May	18,320	5,140	9,031	555,294	2.770	3.194
June, 13 days [a]	11,520	4,940	8,397	216,518	2.576	1.245
July	6,050	1,870	3,469	213,300	1.064	1.227
August, 11 days [b]	1,770	545	1,190	25,964	.365	.149
September	615	370	455	27,074	.140	.156
October	685	405	568	34,925	.174	.201
November	685	580	614	36,536	.188	.210
December	650	440	530	32,588	.163	.188
The period				1,598,070		

[a] June 1 to 7 and 25 to 30 inclusive.
[b] August 1 to 6 and 25 and 28 to 31 inclusive.

CLARK FORK [a] AT PRIEST RIVER, IDAHO.

This station was established in June, 1903, by T. A. Noble, assisted by George H. Bliss. It is located about 1,000 feet west of Priest River railroad station and south of the railroad track, on the right bank. It is about 100 feet west of a sawmill. The stream at this point flows parallel to the railroad track, and both the platform to which the gage is attached and the ferry cable from which measurements are made are at right angles to the track and stream. The gage is of the wire and weight type, with horizontal scale board, fastened to the railing of the platform, which is built between two cottonwood and two black pine trees. The gage is adjusted to read the height of the water surface above sea level. Discharge measurements are made from a ferry cable about 400 feet downstream from the gage. The initial point for soundings is a stake on the left bank of the stream and the west side of the driveway. Its elevation is 2,062.11 feet above sea level. On the right bank 1,020 feet from the initial point is another stake, with a tack in its head. Its elevation above sea level is 2,076.31 feet. The channel is straight for about 2,000 feet above and 4,000 feet below the station. The right bank is high, covered with underbrush, and not subject to overflow. The left bank is low, cleared, and liable to overflow. From the top of the left bank there is an upward slope of about

[a] Formerly called Pend Oreille River.

10 per cent. The water flows in one channel, and the bed of the stream is composed of sand, with occasional bowlders. The bench mark from which all elevations were obtained is the United States Geological Survey bench mark south of Priest River station, at the northeast corner of the hotel. Its elevation above sea level is 2,077 feet. A second bench mark, under the gage board platform, is at an elevation of 2,066.19 feet above sea level. A third, on a stump near the gage, is at an elevation of 2,073.02 feet above sea level. On July 16, 1903, the length of the gage wire from the end of the weight to the marker was measured and found to be 32.60 feet. On the bridge rail on the opposite side from the gage 2 copper tacks were driven 32.60 feet apart, to be used for future checking of the length of the wire by the observer.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Clark Fork at Priest River, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 12	C. E. Hewett	790	5,715	2.50	44.39	14,260
May 27	W. G. Steward	948	16,740	5.34	56.00	89,420
July 20	do	905	10,560	4.28	49.92	45,340
August 11	do	845	7,234	3.13	46.33	22,770

Mean daily gage height, in feet, of Clark Fork at Priest River, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	44.50	43.60	43.50	44.25	52.15	56.30	53.40	47.75	44.40	43.20	42.80	42.80
2	44.45	43.60	43.50	44.30	52.50	56.40	53.25	47.55	44.40	43.15	42.80	42.80
3	44.45	43.70	43.50	44.35	52.75	56.30	53.10	47.40	44.35	43.10	42.80	42.75
4	44.45	43.75	43.50	44.20	52.85	56.40	52.85	47.30	44.30	43.20	42.85	42.80
5	44.35	43.70	43.50	44.35	53.20	56.40	52.65	47.15	44.30	43.15	42.75	42.75
6	44.30	43.70	43.50	44.40	53.45	56.30	52.50	47.00	44.20	43.10	42.75	42.75
7	44.30	43.70	43.60	44.55	53.50	56.40	52.30	46.85	44.15	43.10	42.75	42.70
8	44.30	43.70	43.70	44.70	53.65	56.40	52.15	46.70	44.10	43.05	42.70	42.75
9	44.10	43.60	43.75	44.80	53.65	56.40	51.90	46.50	44.05	43.10	42.75	42.70
10	44.30	43.70	44.10	44.90	53.60	56.20	51.70	46.40	44.00	43.10	42.75	42.65
11	44.25	43.55	44.25	45.00	53.60	56.20	51.50	46.30	43.95	43.10	42.75	42.70
12	44.20	43.50	44.40	45.40	53.65	56.20	51.30	46.15	43.90	43.00	42.70	42.65
13	44.10	43.50	44.45	45.90	53.60	56.00	51.15	46.00	43.90	43.05	42.70	42.70
14	44.10	43.55	44.65	46.35	53.65	55.80	50.90	45.90	43.80	43.00	42.65	42.65
15	44.10	43.60	44.50	47.00	53.55	55.70	50.70	45.75	43.80	43.00	42.65	42.55
16	44.10	43.55	44.60	47.55	53.60	55.40	50.60	45.70	43.80	43.00	42.65	42.70
17	44.20	43.55	44.65	48.20	53.65	55.30	50.35	45.60	43.80	42.95	42.60	42.60
18	44.05	43.55	44.50	48.60	53.70	55.10	50.20	45.40	43.75	42.95	42.60	42.70
19	44.15	43.55	44.55	49.00	53.80	55.20	50.00	45.35	43.70	42.90	42.65	42.65
20	44.10	43.50	44.50	49.25	53.80	55.20	49.95	45.30	43.65	42.90	42.70	42.70

Mean daily gage height, in feet, of Clark Fork at Priest River, Idaho, for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	44.10	43.50	44.50	49.50	54.10	55.10	49.65	45.20	43.50	42.90	42.85	42.65
22	44.05	43.45	44.55	49.85	54.30	55.00	49.40	45.10	43.45	42.90	42.90	42.65
23	44.05	43.40	44.55	50.10	54.80	54.70	49.20	45.05	43.40	42.85	42.90	42.70
24	43.85	43.50	44.65	50.40	55.10	54.70	49.10	44.95	43.45	42.90	42.95	42.65
25	44.00	43.50	44.45	50.60	55.50	54.60	48.85	44.90	43.40	42.90	42.90	42.60
26	43.95	43.50	44.40	50.80	55.80	54.50	48.70	44.85	43.35	42.85	42.85	42.60
27	43.95	43.50	44.40	50.90	56.00	54.30	48.45	44.80	43.30	42.80	42.90	42.65
28	43.85	43.50	44.40	51.10	56.10	54.10	48.35	44.75	43.30	42.80	42.80	42.60
29	43.80	43.45	44.35	51.45	56.20	53.80	48.20	44.65	43.30	42.80	42.85	42.65
30	43.80	.....	44.20	51.90	56.20	53.60	47.95	44.55	43.25	42.80	42.90	42.65
31	43.80	.....	44.25	.....	56.30	.....	47.80	44.40	.....	42.80	.....	42.70

Rating table for Clark Fork at Priest River, Idaho, from June 26, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
42.00	6,550	43.90	12,250	45.80	21,010	49.20	40,740
42.10	6,770	44.00	12,650	45.90	21,530	49.40	41,980
42.20	6,990	44.10	13,050	46.00	22,050	49.60	43,220
42.30	7,220	44.20	13,470	46.20	23,100	49.80	44,470
42.40	7,460	44.30	13,890	46.40	24,190	50.00	45,750
42.50	7,700	44.40	14,320	46.60	25,310	50.50	49,000
42.60	7,960	44.50	14,760	46.80	26,440	51.00	52,300
42.70	8,230	44.60	15,200	47.00	27,600	51.50	55,600
42.80	8,510	44.70	15,650	47.20	28,760	52.00	59,000
42.90	8,810	44.80	16,110	47.40	29,920	52.50	62,400
43.00	9,110	44.90	16,570	47.60	31,080	53.00	65,900
43.10	9,420	45.00	17,050	47.80	32,250	53.50	69,400
43.20	9,740	45.10	17,530	48.00	33,450	54.00	73,100
43.30	10,070	45.20	18,010	48.20	34,650	55.00	81,000
43.40	10,410	45.30	18,490	48.40	35,850	56.00	89,300
43.50	10,750	45.40	18,990	48.60	37,050	57.00	99,000
43.60	11,110	45.50	19,490	48.80	38,260	58.00	109,800
43.70	11,480	45.60	19,990	49.00	39,500	59.00	121,200
43.80	11,860	45.70	20,490				

The above table is applicable only for open-channel conditions. It is based upon 10 discharge measurements made during 1903, 1904, and 1905. It is well defined between gage heights 42.50 feet and 50.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Clark Fork at Priest River, Idaho, for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
July	113,700	44,790	73,940	4,568,000
August	43,900	19,390	28,900	1,777,000
September	18,990	14,280	15,790	939,600
October	16,570	14,230	15,490	952,400
November	18,060	15,420	16,090	957,400
December	17,240	15,110	16,500	1,014,000
The period				10,210,000
1904.				
January	14,760	11,860	13,200	811,600
February	11,670	10,410	11,000	632,700
March	15,420	10,750	13,500	830,100
April	58,320	13,470	31,330	1,864,000
May	92,000	60,020	74,540	4,583,000
June	93,000	70,120	85,040	5,060,000
July	68,700	32,250	49,850	3,065,000
August	31,950	14,320	21,500	1,322,000
September	14,320	9,900	11,920	709,300
October	9,740	8,510	9,057	556,900
November	8,960	7,960	8,437	502,000
December	8,510	7,830	8,182	503,100
The year	93,000	7,830	28,130	20,440,000

PRIEST RIVER AT PRIEST RIVER, IDAHO.

This station was established in June, 1903, by T. A. Noble, assisted by G. H. Bliss. It is located at the highway bridge, on the road from the railroad station at Priest River to Priest Lake. The gage is a vertical board nailed to a pile on the downstream side of the right pier of the highway bridge. A ladder is attached to the pier to facilitate reading the gage. It is read once each day by George Young. Discharge measurements are made from the downstream side of the bridge, to which the gage is attached. The initial point for soundings is the bolt at the end of the guard rail at the right bank. A circle has been painted around the bolt. The channel is straight for 500 feet above and for 200 feet below the bridge. Both banks are high, wooded, and not liable to overflow. Extending from

each pier of the single-span bridge to the bank is a breakwater composed of piles faced with planks. These breakwaters make the current sluggish between the piers and the banks. Under the main span of the bridge, a distance of 120 feet, the current is swift. The bed of the stream is composed of gravel.

Bench mark No. 1 is the bolt in the guard rail at the west end of the bridge, which is used as the initial point for soundings. Its elevation is 29.04 feet above the zero of the gage, and 2,079.7 feet above sea level. Bench mark No. 2 is a spike driven in a stump under the right approach to the bridge. Its elevation is 17.48 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Priest River at Priest River, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 10	C. E. Hewett	115	477	3.01	4.40	1,434
May 3	W. G. Steward	166	906	6.48	7.47	5,882
May 26	Murphy and Steward	129	898	6.40	7.76	5,755
July 21	W. G. Steward	127	504	3.41	4.61	1,720
August 10	do	125	399	2.39	3.70	955
September 16	O. Laurguard	118	307	1.85	2.86	568

Mean daily gage height, in feet, of Priest River at Priest River, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.80	3.65	3.60	4.00	6.60	7.80	5.80	4.10	3.15	2.75	2.70	3.05
2	3.80	3.55	3.65	4.10	6.95	7.90	5.80	4.05	3.15	2.70	2.70	3.00
3	3.80	3.60	3.60	4.15	7.45	7.85	5.70	4.00	3.10	2.70	2.65	3.00
4	3.80	3.65	3.65	4.25	7.45	7.90	5.70	3.95	3.10	2.70	2.65	3.00
5	3.80	3.70	3.65	4.35	7.45	7.80	5.60	3.90	3.05	2.70	2.65	3.00
6	3.75	3.70	3.75	4.75	7.40	7.85	5.45	3.85	3.00	2.70	2.65	2.95
7	3.75	3.70	3.85	4.75	7.35	7.90	5.35	3.85	3.00	2.75	2.65	2.95
8	3.75	3.70	4.15	4.75	7.25	7.90	5.30	3.80	3.00	2.80	2.65	2.95
9	3.75	3.70	4.45	4.80	7.20	7.85	5.20	3.75	2.95	2.80	2.65	2.95
10	3.75	3.65	4.40	4.95	7.15	7.75	5.10	3.70	2.95	2.80	2.65	2.95
11	3.75	3.70	4.40	5.20	7.10	7.70	5.10	3.65	2.90	2.80	2.60	2.95
12	3.75	3.70	4.30	5.45	7.05	7.60	4.95	3.60	2.90	2.75	2.60	3.00
13	3.75	3.70	4.30	5.70	7.00	7.40	5.00	3.60	2.90	2.70	2.60	2.95
14	3.75	3.70	4.25	6.00	7.00	7.30	4.90	3.55	2.90	2.75	2.60	3.00
15	3.80	3.70	4.20	6.50	7.00	7.20	4.90	3.55	2.85	2.70	2.65	3.10
16	3.90	3.70	4.10	6.70	7.00	7.10	4.85	3.50	2.85	2.75	2.70	3.10
17	3.95	3.70	4.30	6.70	7.00	6.95	4.80	3.50	2.85	2.70	2.70	3.10
18	3.95	3.70	4.15	6.60	7.00	6.95	4.75	3.45	2.85	2.70	2.70	3.05
19	3.90	3.65	4.10	6.50	7.15	7.00	4.70	3.45	2.80	2.70	2.70	3.05
20	3.80	3.65	4.15	6.50	7.20	6.95	4.65	3.40	2.80	2.70	2.95	3.05
21	3.85	3.65	4.10	6.60	7.30	6.80	4.60	3.35	2.75	2.70	3.50	3.05

Mean daily gage height, in feet, of Priest River at Priest River, Idaho, for 1904—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
22	3.95	3.65	4.10	6.80	7.45	6.65	4.55	3.35	2.85	2.70	3.45	3.05
23	3.80	3.60	4.05	6.90	7.60	6.60	4.50	3.30	2.85	2.65	3.15	2.95
24	3.80	3.65	4.05	6.90	7.70	6.55	4.45	3.25	2.85	2.65	3.10	3.00
25	3.75	3.65	3.90	6.85	7.75	6.40	4.40	3.25	2.80	2.65	3.05	3.00
26	3.75	3.70	3.90	6.90	7.75	6.20	4.35	3.20	2.75	2.65	3.05	3.00
27	3.70	3.70	3.90	7.10	7.80	6.15	4.30	3.20	2.75	2.65	3.05	3.00
28	3.70	3.60	3.95	7.30	7.80	6.05	4.25	3.20	2.75	2.65	3.05	3.00
29	3.70	3.65	3.95	7.60	7.80	6.00	4.20	3.20	2.75	2.65	3.05	3.00
30	3.65	.....	4.00	7.65	7.80	5.85	4.15	3.20	2.75	2.65	3.05	3.20
31	3.65	.....	4.00	.....	7.80	.....	4.10	3.15	.....	2.70	.....	3.25

Rating table for Priest River at Priest River, Idaho, from June 28, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.50	460	3.90	1,085	5.30	2,480	7.40	5,820
2.60	485	4.00	1,160	5.40	2,600	7.60	6,200
2.70	515	4.10	1,240	5.50	2,720	7.80	6,580
2.80	545	4.20	1,325	5.60	2,850	8.00	6,960
2.90	580	4.30	1,410	5.70	2,980	8.20	7,360
3.00	615	4.40	1,500	5.80	3,120	8.40	7,760
3.10	655	4.50	1,590	5.90	3,260	8.60	8,160
3.20	695	4.60	1,690	6.00	3,400	8.80	8,560
3.30	740	4.70	1,790	6.20	3,700	9.00	8,960
3.40	785	4.80	1,900	6.40	4,020	9.20	9,360
3.50	835	4.90	2,010	6.60	4,350	9.40	9,760
3.60	890	5.00	2,120	6.80	4,700	9.60	10,160
3.70	950	5.10	2,240	7.00	5,060	9.80	10,560
3.80	1,015	5.20	2,360	7.20	5,440		

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is fairly well defined between gage heights 2.80 feet and 7.50 feet. The table has been extended beyond these limits. Above gage height 8.00 feet the rating curve is a tangent, the difference being 200 per tenth.

Estimated monthly discharge of Priest River at Priest River, Idaho, for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
July	8,760	1,720	3,854	237,000
August	1,690	956	1,360	83,620
September	1,092	830	926	55,100
October	1,092	820	978	60,140
November	1,316	890	1,033	61,470
December	1,368	1,036	1,188	73,050
The period				570,400
1904.				
January	1,122	920	1,007	61,920
February	950	862	930	53,490
March	1,545	890	1,196	73,540
April	6,295	1,160	3,503	208,400
May	6,580	4,350	5,693	350,000
June	6,770	3,190	5,354	318,600
July	3,120	1,240	2,034	125,100
August	1,240	675	878	53,990
September	675	530	580	34,510
October	545	500	517	31,790
November	835	485	564	33,560
December	718	598	624	38,370
The year	6,770	485	1,907	1,383,000

SPOKANE RIVER AT SPOKANE, WASH.

This gaging station was originally established October 17, 1896, by C. C. Babb, on the Oregon Railroad and Navigation Company's wooden bridge, about 1 mile above the falls, where discharge measurements and gage readings were taken until July 8, 1903. The distance from the end of the weight to the index of the first wire gage was 22.00 feet, and from the zero of the rod to the outside edge of the pulley 1.80 feet. The gage datum was found to be 1,880 feet above sea level by city datum and 1,865 feet by Government datum.

During 1901 new gages and bench marks were established. The bench mark is a railroad spike in an electric-railway pole close to, and on the south side of the railroad track, at the west end of bridge. Its elevation is 1,896.86 feet above city datum, as determined by the Washington Water Power Company, and 1,882.72 feet above Government datum, as determined by the United States Geological

Survey, July 6, 1903, from a Government bench mark at the county court-house in Spokane.

A second wire gage was afterwards established on the north side of the west span of the bridge. The zero of this gage was at an elevation of 1,879.35 feet, coinciding with the position of the zero of the old gage. The distance from the end of the weight of the marker was also 22.00 feet, but the distance from the zero of the rod to the outside of the pulley was only 1.90 feet.

In July, 1903, the wooden bridge was torn out to be replaced by a steel structure, and the second gage board was destroyed. A third wire gage was established July 8, 1903, on the Olive Avenue Bridge, 950 feet below the railroad bridge. It is located on the south side of the bridge, between the fifth and seventh verticals from the west end, just outside a wooden conduit for pipes. It is 22.30 feet between the end of weight and marker.

The bench mark is a railroad spike in the north face of the first telegraph pole west of the west approach to bridge. Its elevation is 1,881.05 feet above Government datum and 17.16 feet above rod datum.

This gage was established with the idea that readings taken at this point would be a continuation of readings taken at the Oregon Railroad and Navigation Company's bridge, as the two gages were made to read the same when the new one was put in place, and both sections are practically the same. For two weeks before the second gage (that on the railroad bridge) was destroyed, simultaneous readings were obtained, which showed no appreciable difference. The slope in the water surface between the two stations was 1.43 feet on July 8, 1904. At all of the above stations near the Oregon Railroad and Navigation Company's bridge, Mr. Z. Taylor, station agent, has been the observer.

On March 30, 1905, the station on the Olive Avenue Bridge was abandoned, and as the new steel bridge of the Oregon Railroad and Navigation Company was no longer considered safe from which to measure the river, on account of the exposure to danger, a new cable station was established about one-half mile above the Mission Street Bridge, or 1 mile above the former stations at the Oregon Railroad and Navigation Company and Olive Avenue bridges. The station is equipped with $\frac{5}{8}$-inch cable, stay wire, and tag wire. The gage is vertical and is fastened to the inside of the most easterly pier on the south side of the Mission Street Bridge, one-half mile below the station. It is divided into feet and tenths, and is read once each day by Mr. A. C. Lingle, a carpenter living near the gage. A secondary gage is located about 100 feet above the cable, and is read by the hydrographer, at the time of measurement, to assist in computing areas. The upper portion is vertical and is fastened to a cottonwood

tree; the lower portion is inclined and nailed to pieces buried in the ground. The rod is divided vertically into feet and tenths. The section here is a good one for stream measurements; the bed is composed of gravel and small bowlders and not liable to change. The banks on both sides are high and will not overflow. The current, except at the lowest stages, is swift.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Spokane River at Spokane, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 25	W. W. Schlecht	260	4,298	6.12	11.84	26,420
May 13	W. G. Steward	252	3,875	5.50	10.22	21,300
June 3	C. M. Hurlburt	253	3,722	5.10	9.06	18,980
June 15	do	236	3,219	4.19	7.60	13,490
June 20	W. G. Steward	230	3,025	3.87	7.00	11,690
June 27	do	227	2,906	3.36	5.90	9,771
July 5	do	223	2,593	2.91	5.02	7,539
July 12	C. M. Hurlburt	221	2,411	2.82	4.31	6,794
July 22	W. G. Steward	216	2,169	2.11	3.56	4,580
July 30	C. M. Hurlburt	212	1,938	1.89	2.99	3,648
August 8	do	215	2,034	1.68	2.50	3,414
August 20	Price and Hurlburt	214	1,778	1.32	2.08	2,339
August 29	O. Laurgaard	203	1,779	1.10	1.85	1,966
August 29 [a]	do	221	626	3.20	1.84	2,006
September 16	C. Casteel	201	1,696	.96	1.56	1,630
September 22	do	200	1,668	.88	1.47	1,465
September 22 [b]	C. E. Hewett	182	1,111	1.31	1.47	1,458
October 6	do	202	1,651	.85	1.39	1,398
October 20	G. G. Mair	202	1,660	.83	1.42	1,384
October 20	do	202	1,656	.85	1.42	1,400

[a] Olive Avenue Bridge, one-half mile below station. [b] 250 feet below Olive Avenue Bridge.

NOTE.—All measurements, 1904, were taken at cable station, except as noted.

Mean daily gage height, in feet, of Spokane River at Spokane (Olive Avenue Bridge), Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	3.65	3.05	3.20	4.75	17	3.10	2.75	5.95	.....
2	3.60	3.00	3.25	4.75	18	3.20	2.75	5.75	.....
3	3.55	3.00	3.25	4.75	19	3.30	2.75	5.65	.....
4	3.50	2.90	3.25	4.90	20	3.35	2.75	5.70	.....
5	3.45	2.90	3.25	5.00	21	3.40	2.75	5.70	.....
6	3.40	2.90	3.35	5.20	22	3.40	2.75	5.70	.....
7	3.40	2.90	3.40	5.40	23	3.40	2.80	5.60	.....
8	3.35	2.80	3.75	5.60	24	3.35	2.85	5.50	.....
9	3.30	2.80	4.50	5.75	25	3.35	2.90	5.40	.....
10	3.25	2.80	5.30	(a)	26	3.30	2.95	5.30	.....
11	3.25	2.75	5.80	.....	27	3.25	3.05	5.15	.....
12	3.25	2.75	5.95	.....	28	3.25	3.10	5.05	.....
13	3.25	2.75	6.00	.....	29	3.20	3.20	4.95	.....
14	3.25	2.75	6.00	.....	30	3.15	.....	4.95	.....
15	3.30	2.70	6.00	.....	31	3.10	.....	4.80	.....
16	3.40	2.70	5.95	.....					

[a] Discontinued.

NOTE.—Readings approximate—about 5 per cent too large.

Mean daily gage height, in feet, of Spokane River at Spokane (Mission Street Bridge), Wash., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.50	11.95	9.25	5.50	2.85	1.85	1.45	1.40	1.60
2	.....	5.50	12.00	9.15	5.40	2.85	1.80	1.45	1.40	1.65
3	.....	5.50	11.85	9.10	5.30	2.80	1.80	1.45	1.40	1.70
4	.....	5.60	11.70	9.00	5.20	2.75	1.75	1.45	1.40	1.70
5	.....	5.70	11.60	8.90	5.05	2.70	1.75	1.40	1.40	1.70
6	.....	5.90	11.50	8.75	4.95	2.60	1.75	1.40	1.40	1.70
7	.....	6.10	11.35	8.70	4.85	2.55	1.75	1.40	1.40	1.75
8	.....	6.30	11.20	8.60	4.75	2.55	1.70	1.40	1.40	1.70
9	.....	6.45	11.00	8.55	4.65	2.45	1.70	1.40	1.35	1.70
10	.....	6.60	10.70	8.45	4.50	2.45	1.70	1.40	1.35	1.70
11	.....	6.80	10.50	8.30	4.40	2.40	1.70	1.40	1.35	1.70
12	.....	7.30	10.35	8.15	4.30	2.35	1.65	1.40	1.35	1.70
13	.....	7.90	10.25	8.00	4.25	2.30	1.65	1.35	1.35	1.70
14	.....	8.60	10.15	7.80	4.10	2.30	1.60	1.35	1.35	1.75
15	.....	9.40	10.05	7.65	4.00	2.25	1.60	1.35	1.35	1.75
16	.....	10.30	10.00	7.50	4.00	2.25	1.55	1.35	1.35	1.75
17	.....	11.30	9.90	7.35	3.90	2.20	1.50	1.35	1.40	1.75
18	.....	11.80	9.85	7.30	3.85	2.20	1.50	1.40	1.35	1.75
19	.....	11.90	9.80	7.15	3.80	2.15	1.50	1.40	1.35	1.70
20	.....	11.90	9.85	7.05	3.70	2.10	1.50	1.40	1.35	1.70
21	.....	12.00	9.85	6.95	3.65	2.10	1.45	1.45	1.40	1.65
22	.....	12.10	9.85	6.80	3.55	2.05	1.45	1.45	1.40	1.65
23	.....	12.10	9.90	6.65	3.50	2.00	1.45	1.45	1.40	1.70
24	.....	12.10	10.00	6.50	3.40	2.00	1.45	1.45	1.50	1.70
25	.....	11.90	10.10	6.30	3.35	2.00	1.45	1.45	1.50	1.70
26	.....	11.70	10.10	6.20	3.25	1.95	1.45	1.40	1.55	1.70
27	.....	11.50	9.95	6.00	3.20	1.90	1.45	1.40	1.55	1.70
28	.....	11.45	9.80	5.90	3.10	1.85	1.45	1.40	1.55	1.70
29	.....	11.55	9.60	5.70	3.05	1.85	1.45	1.40	1.60	1.70
30	5.60	11.70	9.50	5.60	3.00	1.85	1.45	1.40	1.60	1.75
31	5.55	.....	9.35	.....	2.95	1.85	.....	1.40	.....	1.80

Rating table for Spokane River at Spokane, Wash., from April 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	940	2.70	3,260	4.40	6,280	7.00	11,830
1.10	1,030	2.80	3,420	4.50	6,470	7.20	12,330
1.20	1,130	2.90	3,580	4.60	6,660	7.40	12,850
1.30	1,240	3.00	3,740	4.70	6,850	7.60	13,380
1.40	1,360	3.10	3,910	4.80	7,050	7.80	13,930
1.50	1,490	3.20	4,080	4.90	7,250	8.00	14,490
1.60	1,620	3.30	4,250	5.00	7,450	8.50	15,900
1.70	1,760	3.40	4,420	5.20	7,850	9.00	17,380
1.80	1,900	3.50	4,600	5.40	8,250	9.50	18,980
1.90	2,040	3.60	4,780	5.60	8,660	10.00	20,580
2.00	2,190	3.70	4,960	5.80	9,080	10.50	22,280
2.10	2,340	3.80	5,140	6.00	9,510	11.00	23,980
2.20	2,490	3.90	5,330	6.20	9,950	11.50	25,780
2.30	2,640	4.00	5,520	6.40	10,400	12.00	27,580
2.40	2,790	4.10	5,710	6.60	10,860	12.50	29,380
2.50	2,940	4.20	5,900	6.80	11,340	13.00	31,180
2.60	3,100	4.30	6,090				

The above table is applicable only for open-channel conditions. It is based upon 20 discharge measurements made during 1904. It is well defined between gage heights 1.40 feet and 12.00 feet. The table has been extended beyond these limits. Above gage height 11.00 feet the rating curve is a tangent, the difference being 360 per tenth.

Estimated monthly discharge of Spokane River at Spokane (Olive Avenue Bridge), Wash., for 1904.

[Drainage area, 4,005 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	6,174	4,958	5,459	335,700	1.36	1.57
February	5,172	4,141	4,305	247,600	1.07	1.15
March	12,420	5,172	9,574	588,700	2.39	2.76
April 1–9	11,680	8,896	9,917	177,000	2.48	.830
The period				1,349,000		

NOTE.—Estimates are based on rating curve of station at O. R. & N. Rwy. bridge, 900 feet above, where conditions are nearly the same as at Olive avenue.

Estimated monthly discharge of Spokane River at Spokane (Mission Street Bridge), Wash., for 1904.

[Drainage area, 4,005 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March 30–31			8,608	34,150	2.15	0.160
April	27,940	8,450	18,780	1,117,000	4.69	5.23
May	27,580	18,500	22,120	1,360,000	5.52	6.36
June	18,180	8,660	13,510	803,900	3.37	3.76
July	8,450	3,660	5,706	350,800	1.42	1.64
August	3,500	1,970	2,605	160,200	.650	.749
September	1,970	1,425	1,617	96,220	.404	.451
October	1,425	1,300	1,369	84,180	.342	.394
November	1,620	1,300	1,384	82,360	.346	.386
December	1,900	1,620	1,769	108,800	.442	.510
The period				4,198,000		

HANGMAN CREEK AT TEKOA, WASH.

This station was established April 1, 1904, by W. W. Schlecht. It is located at the footbridge across Hangman Creek about 1,000 feet above the mouth of North Fork of Hangman Creek, in the town of Tekoa, Wash. There is a fall of about 2½ feet between the two points. A plain staff gage, graduated to feet and tenths, is attached vertically to the right pile bent of the bridge. It is read once each day by A. C. McLaughlin. Discharge measurements are made from the downstream side of the footbridge to which the gage is attached. The initial point for soundings is the center of a telegraph pole on the right bank, marked with a 20-penny nail and zero. Five-foot intervals are marked on the bridge. The channel is straight for about 75 feet above and 40 feet below the station. The current is sluggish. About 50 feet below the station is the head of a series of rapids. The right bank is fringed with brush, and liable to overflow to the railroad embankment, about 50 feet. The left bank is high, steep, composed of clay, fringed with brush, and not subject to overflow. The bed of the stream is composed of solid rock with earth banks and is not liable to shift. The station may at times be affected by backwater from the North Fork.

Bench mark No. 1 is a standard United States Geological Survey aluminum tablet marked "2537" set in the vertical wall of a brick house on the corner one square north of the bank of Tekoa. Its elevation is 62.11 feet above the zero of the gage. Bench mark No. 2

is the top of the head of a 60-penny spike driven into the telegraph pole at the initial point for soundings. Its elevation is 11.41 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Hangman Creek at Tekoa, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
April 2	W. W. Schlecht	69	383	0.98	4.88	376
April 5	do	68	409	1.17	5.25	480
April 20	W. G. Steward	60	308	.87	4.20	281
May 6	W. W. Schlecht	28	65	1.21	2.17	78
May 16	W. G. Steward	15	21	1.75	1.47	37
May 24	Steward and Murphy	15	17	1.42	1.15	24
June 4	W. W. Schlecht	16	18	1.46	1.45	26
June 22	W. G. Steward	14	12	.71	.74	8
July 16 [a]	do	8	4	1.07	.58	4
July 16 [b]	do	13	10	.41	.58	4
August 29 [c]	do	1	.35	.80	.41	.28
August 29 [a]	do	1.5	.45	1.02	.42	.46

[a] One-half mile below station.
[b] 300 feet above station.
[c] 150 feet above railroad bridge.

Mean daily gage height, in feet, of Hangman Creek at Tekoa, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.
1	4.90	2.95	1.00	0.60	0.45	0.40	0.40	0.70	0.6
2	4.90	2.90	1.00	.60	.45	.40	.40	.70	.6
3	5.40	2.70	1.05	.60	.45	.40	.40	.70	.6
4	5.40	2.40	1.45	.60	.45	.40	.40	.70	.6
5	5.30	2.20	1.50	.65	.45	.40	.40	.70	.6
6	5.55	2.10	1.35	.65	.45	.40	.40	.65	.6
7	5.30	2.05	1.30	.65	.40	.40	.45	.65	.6
8	4.85	1.95	1.50	.65	.40	.40	.45	.65	.6
9	4.65	1.85	1.55	.65	.40	.40	.50	.65	.7
10	4.90	1.80	1.30	.45	.40	.40	.50	.65	.7
11	5.80	1.90	1.20	.45	.40	.40	.50	.60	.7
12	6.30	1.85	1.15	.45	.40	.40	.60	.55	.7
13	6.20	1.70	1.00	.45	.40	.40	.60	.55	.7
14	6.10	1.60	.95	.45	.40	.40	.60	.55	.7
15	6.20	1.55	1.00	.45	.40	.40	.65	.55	.8
16	6.90	1.50	.95	.50	.40	.40	.65	.60	.9
17	5.75	1.45	.90	.60	.40	.40	.65	.60	.8
18	4.85	1.40	.95	.60	.40	.40	.70	.60	.8
19	4.30	1.40	.95	.60	.40	.40	.70	.60	.8
20	4.30	1.30	.90	.55	.40	.40	.70	.65	.8
21	4.20	1.35	.90	.60	.40	.40	.70	.65	.8
22	4.20	1.25	.75	.55	.40	.40	.70	.70	.8

Mean daily gage height, in feet, of Hangman Creek at Tekoa, Wash, for 1904—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
23	4.10	1.20	0.75	0.55	0.40	0.40	0.70	0.70	0.80
24	3.80	1.15	1.20	.55	.40	.40	.70	.70	.80
25	3.50	1.10	2.35	1.20	.40	.40	.70	.70	.80
26	3.20	1.00	2.20	1.80	.40	.40	.70	.75	.80
27	3.05	.95	2.15	.45	.40	.40	.70	.75	.80
28	3.25	1.00	2.15	.45	.40	.45	.70	.75	.85
29	3.40	.95	1.10	.45	.40	.45	.70	.70	.85
30	3.20	.95	.60	.45	.40	.45	.65	.70	.90
31	.....	.90	.....	.45	.40	.....	.65	.....	.90

NOTE.—Gage heights affected by opening of floodgate.

Rating table for Hangman Creek at Tekoa, Wash., from April 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.40	0.2	1.40	34	3.00	142	4.50	318
.45	1.0	1.50	38	3.10	150	4.60	335
.50	2.0	1.60	43	3.20	158	4.70	353
.55	3.0	1.70	49	3.30	167	4.80	372
.60	4.5	1.80	55	3.40	177	4.90	392
.65	6.0	1.90	61	3.50	187	5.00	412
.70	7.5	2.00	67	3.60	197	5.10	434
.75	9.0	2.10	73	3.70	207	5.20	456
.80	10.5	2.20	79	3.80	218	5.30	478
.85	12	2.30	86	3.90	230	5.40	500
.90	14	2.40	94	4.00	243	5.50	522
.95	16	2.50	102	4.10	257	5.60	546
1.00	18	2.60	110	4.20	271	5.70	570
1.10	22	2.70	118	4.30	286	5.80	594
1.20	26	2.80	126	4.40	302	5.90	618
1.30	30	2.90	134				

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1904. It is well defined between gage heights 0.40 foot and 5.30 feet. The table has been extended beyond these limits. Above gage height 5.50 feet the rating curve is a tangent, the difference being 24 per tenth.

Estimated monthly discharge of Hangman Creek at Tekoa, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	858	146	405	24,100
May	138	14	50.1	3,080
June	79	4.5	29.9	1,779
July	56	1	5.6	344
August	1	.2	.35	22
September	1	.2	.28	17
October	7.5	.2	4.6	283
November	9	3	6.2	369
December	14	6	9.2	566
The period				30,560

HANGMAN CREEK AT POOLE'S RANCH, NEAR TEKOA, WASH.

This station was established September 28, 1904, by T. A. Noble. It is located 4 miles northwest of Tekoa, Wash., one-fourth mile south of highway bridge across Hangman Creek, and 300 feet south of J. M. Poole's farm crossing. A 6-inch hook gage is used once each day by John M. Poole. Discharge measurements are made by means of a weir 14 feet long. The top of the weir is the same height as the top of a nail driven into the plank which forms part of the dead-man for the bench mark, 7 feet upstream from the weir. The channel is straight for about 80 feet above and 25 feet below the station and the current is sluggish. Both banks are about 6 to 8 feet high, lined with brush, and subject to overflow during high water. The bed of the stream is composed of rock, cemented gravel, free from vegetation, and permanent. There is but one channel at low, and two at high water. The bench mark is the top of a 60-penny nail driven into right-of-way post of the Oregon Railroad and Navigation Company, 40 feet east of the weir. Its elevation is 8.627 feet above the top of the weir or iron lip.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Hangman Creek at Poole's ranch near Tekoa, Wash., for 1905.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	0.383	0.364	0.385	17	.....	0.414	0.382	0.744
2	.....	.383	.376	.419	18	.....	.384	.446	.628
3	.....	.362	.375	.386	19	.....	.340	.445	.733
4	.....	.384	.365	.418	20	.....	.444	.463	.688
5	.....	.314	.377	.398	21	.....	.372	.480	.552
6	.....	.345	.365	.388	22	.....	.375	.554	.534
7	.....	.412	.384	.323	23	.....	.395	.610	.533
8	.....	.496	.375	.379	24	.....	.383	.782	.532
9	.....	.460	.383	.323	25	.....	.385	.647	.....
10	.....	.520	.361	.333	26	.....	.387	.589	.....
11	.....	.570	.371	.354	27	.....	.364	.528	.....
12	.....	.563	.393	.437	28	0.347	.354	.491	.....
13	.....	.571	.394	.466	29	.344	.342	.461	.....
14	.....	.620	.394	.518	30	.383	.388	.415	.....
15	.....	.726	.393	.617	31	.....	.386	.....	.....
16	.....	.442	.370	.779					

From September 28 to October 15, inclusive, length of weir, 1.01 feet; from October 16 to November 24, inclusive, length of weir, 3 feet; from November 25 to December 24, inclusive, length of weir, 5 feet.

HANGMAN CREEK (NORTH FORK) AT TEKOA, WASH.

This station was established April 2, 1904, by W. W. Schlecht. It is located at the highway bridge in Tekoa, Wash., on the road leading north. A plain staff gage, graduated to feet and tenths, is fastened vertically to the concrete abutment of the railway bridge on the northern arm of the "Y" of the Oregon Railroad and Navigation Company's tracks, 25 feet upstream from the bridge from which discharge measurements are made. The gage is read once each day by C. J. McLaughlin. Discharge measurements are made from the downstream side of the highway bridge. The initial point for soundings is the center of telegraph pole on the right bank. It is indicated by a 20-penny nail and marked zero. Five-foot intervals are marked on the bridge. The channel is straight for about 60 feet above and below the station and the current is swift. There is a series of rapids between the gaging station and the mouth of the creek, having a total fall of about 4 to 5 feet. The right bank is of earth, fringed with brush, having a number of houses built close to the river, and does not overflow. The left bank is low, and is liable to overflow above and below the station 50 to 100 feet back to the railroad embankment. The bed of the stream is composed of gravel and a few bowlders, and is permanent. At the gaging section there is but one channel at all stages.

Bench mark No. 1 is a United States Geological Survey standard aluminum tablet set in the vertical wall of a brick house on the corner 1 square north of the bank in Tekoa. It is marked "2537" and is 58.29 feet above the zero of the gage. Bench mark No. 2 is a point

on the concrete abutment of the railroad bridge near the gage. Its elevation is 8.39 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Hangman Creek (North Fork) at Tekoa, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 2	W. W. Schlecht	44	119	1.71	2.28	203
April 9	do	44	108	1.09	1.88	117
April 20	W. G. Steward	40	93	.38	1.50	37
May 6 [a]	W. W. Schlecht	18	13	.79	1.23	10
May 11 [a]	W. G. Steward	30	2.8	1.36	.80	3.8
May 24 [a]	Murphy and Steward	.....	1.9	.83	.62	1.6
June 22 [a]	W. G. Steward	3	1.9	.35	.42	.67
July 16 [a]	do	3	1.8	.38	.50	.70
August 29 [a]	do	.8	.24	1.17	.42	.28

[a] Not at regular section.

Mean daily gage height, in feet, of Hangman Creek (North Fork) at Tekoa, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.30	0.65	0.40	0.47	0.44	0.44	0.70	0.70
2	2.30	1.40	.70	.47	.47	.44	.44	.70	.70
3	2.35	1.30	1.00	.47	.46	.44	.44	.70	.70
4	2.25	1.20	1.00	.50	.46	.44	.44	.70	.70
5	2.20	1.15	.75	.50	.46	.44	.44	.70	.70
6	2.30	1.20	.75	.47	.46	.44	.44	.70	.70
7	1.94	1.20	.75	.47	.47	.44	.45	.70	.70
8	1.93	1.10	.80	.50	.46	.44	.46	.75	.70
9	1.90	1.00	.70	.50	.46	.44	.50	.70	.70
10	1.90	1.00	.65	.47	.45	.44	.50	.70	.70
11	1.95	1.20	.50	.47	.45	.44	.60	.70	.75
12	1.98	1.00	.55	.46	.45	.44	.60	.70	.75
13	1.80	.90	.60	.47	.45	.44	.60	.70	.76
14	1.70	.90	.55	.47	.46	.44	.60	.70	.76
15	1.90	.80	.43	.47	.46	.44	.60	.70	.77
16	2.00	.80	.50	.50	.45	.44	.65	.70	.85
17	1.70	.77	.50	.60	.45	.44	.66	.70	.80
18	1.70	.77	.50	.50	.44	.44	.70	.70	.85
19	1.50	.80	.50	.50	.44	.44	.70	.70	.85
20	1.30	.85	.45	.50	.44	.44	.70	.75	.85
21	1.30	.77	.45	.50	.43	.44	.70	.75	.85
22	1.70	.70	.45	.47	.43	.44	.70	.75	.85
23	1.70	.70	.40	.47	.43	.44	.70	.75	.85
24	1.50	.55	.40	.47	.43	.44	.70	.67	.80
25	1.50	.40	.40	.50	.43	.44	.70	.70	.80
26	1.40	.40	.90	.50	.44	.44	.70	.70	.80
27	1.40	.40	.40	.50	.44	.44	.70	.70	.90
28	1.45	.50	.35	.50	.44	.44	.70	.70	.98
29	1.40	.35	.40	.50	.44	.44	.65	.70	.98
30	1.40	.50	.40	.50	.44	.44	.65	.70	.98
31	.....	.50	.....	.47	.44	.....	.65	.....	.99

Rating table for Hangman Creek (North Fork) at Tekoa, Wash., from April 2 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.35	0.1	.80	3.5	1.25	10.6	1.90	121
.40	.2	.85	4.0	1.30	13.0	2.00	142
.45	.4	.90	4.6	1.35	16.4	2.10	163
.50	.7	.95	5.4	1.40	21.4	2.20	184
.55	1.0	1.00	6.2	1.45	29	2.30	205
.60	1.5	1.05	7.0	1.50	37	2.40	226
.65	2.0	1.10	7.8	1.60	58		
.70	2.5	1.15	8.6	1.70	79		
.75	3.0	1.20	9.4	1.80	100		

The above table is applicable only for open-channel conditions. It is based upon 9 discharge measurements. It is well defined between gage heights 0.30 foot and 2.30 feet. The table has been extended beyond these limits. Above gage height 2.40 the rating curve is a tangent, the difference being 22 per tenth.

Estimated monthly discharge of Hangman Creek (North Fork) at Tekoa, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 2–30	215	21.4	95.8	5,510
May	21.4	.1	5.23	322
June	6.2	.1	1.61	96
July	1.5	.2	.62	38
August	.5	.3	.42	26
September	.4	.4	.40	24
October	2.5	.4	1.61	99
November	3.0	2.2	2.57	153
December	6.0	2.5	3.57	220
The period				6,488

LITTLE SPOKANE RIVER NEAR SPOKANE, WASH.

This station was established August 3, 1903, by George H. Bliss. It is located about 2 miles above the mouth of the river at the second bridge above the mouth. It is 9 miles northwest of Spokane, Wash., and 1½ miles northeast of what is known as the "9-mile bridge" over Spokane River. The wire gage is located on the upstream side of the bridge. The center of the pulley is 105 feet from the south end of the bridge. The length of the wire from the end of the weight to the

marker is 13.25 feet. This distance has been laid off on the upper surface of the bottom rail near the gage and is marked by copper tacks inclosed in circles of black paint. These marks are used in checking the length of the gage wire. The gage is read once each day by Mary A. Keenan. Discharge measurements are made from the upstream side of the bridge to which the gage is attached. The initial point for soundings is the vertical end post on the upstream side of the bridge at the south approach. The channel is straight for 100 feet above and 150 feet below the station. The current is swift. Both banks are high, covered with underbrush, and liable to overflow only at very high stages. The bed of the stream is composed of clean gravel. The channel is broken by four bridge piers and has a width at ordinary stages of about 125 feet. The bench mark is a wire nail driven into the root of a black pine tree 2 feet in diameter. The root is on the north side of the tree and extends toward the bridge. It is 60 feet distant from the south end of the bridge. The tree is blazed. It is marked "B. M." with black paint. The bench mark has an elevation of 21.00 feet above gage datum.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Little Spokane River near Spokane, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 3	G. H. Bliss	134	544	1.54	8.90	838
April 19	W. G. Steward	122	801	3.02	10.98	2,416
May 20	Steward and Murphy	102	546	1.56	8.48	850

Mean daily gage height, in feet, of Little Spokane River near Spokane, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.60	6.68	7.50	8.95	10.60	7.33	6.60	6.10	6.09	6.10	6.35	6.30
2	6.60	6.65	7.35	8.94	9.82	7.40	6.50	6.30	6.15	6.29	6.30	6.34
3	6.60	6.57	7.10	8.91	9.76	7.50	6.40	6.20	6.20	6.30	6.29	6.20
4	6.65	6.65	7.10	9.15	9.60	7.40	6.70	6.20	6.15	6.10	6.25	6.27
5	6.68	6.74	7.30	9.56	9.62	7.45	7.35	6.18	6.20	6.15	6.18	6.28
6	6.50	6.90	7.55	9.90	9.55	7.60	7.32	6.30	6.01	6.23	6.24	6.19
7	6.60	6.75	7.90	10.20	9.40	7.70	7.40	6.21	6.04	6.30	6.30	6.30
8	6.55	6.80	8.60	10.15	9.35	7.04	7.45	6.20	6.00	6.05	6.20	6.25
9	6.62	6.70	9.55	10.05	9.32	7.50	7.32	6.19	6.01	6.19	6.30	6.34
10	6.70	6.50	9.55	10.20	9.21	7.34	6.40	6.24	6.03	6.18	6.34	6.40
11	6.68	6.64	9.40	10.50	9.16	7.24	6.45	6.30	6.10	6.20	6.35	.....
12	6.70	6.70	9.30	10.85	9.00	7.10	6.50	6.20	6.01	6.19	6.37	.....
13	6.78	6.80	9.25	10.90	8.96	7.00	6.40	6.17	6.00	6.20	6.30	.....
14	6.78	6.75	9.30	11.00	8.84	7.05	6.20	6.20	5.99	6.10	6.25	.....
15	6.80	6.78	9.25	11.30	8.82	6.85	6.30	6.15	5.99	6.23	6.40	.....
16	6.80	6.76	9.30	[a]12.00	8.00	6.82	6.40	6.20	6.01	6.25	6.10	.....

[a] Highest water in 17 years, according to observer.

Mean daily gage height, in feet, of Little Spokane River near Spokane, Wash., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17	7.05	6.90	9.20	11.70	8.76	6.75	6.50	6.15	6.00	6.09	6.29	.....
18	7.10	6.80	9.15	11.20	8.68	6.50	6.40	6.20	6.13	6.10	6.50	.....
19	7.05	6.70	9.20	11.00	8.53	6.60	6.30	6.05	6.00	6.08	6.27	.....
20	6.85	6.90	9.20	10.94	8.30	6.50	6.45	6.16	6.20	6.00	6.39	.....
21	6.80	6.70	9.25	10.60	8.15	6.50	6.20	6.18	6.25	6.16	6.40	.....
22	6.89	6.90	9.15	10.55	8.20	6.65	6.32	6.15	6.30	6.39	6.25	.....
23	6.85	7.50	9.10	10.42	8.13	6.70	6.48	6.13	6.20	6.40	6.30	.....
24	6.67	7.11	9.05	10.35	8.10	6.60	6.32	6.17	6.00	6.20	6.28	.....
25	6.65	7.15	9.00	10.20	8.00	6.55	6.00	6.10	6.29	6.50	6.30	.....
26	6.65	7.25	8.85	10.07	7.95	6.50	6.15	6.08	6.18	6.48	6.45	.....
27	6.67	7.40	8.64	10.17	7.90	6.45	6.30	6.15	6.23	6.69	6.30	.....
28	6.71	7.60	8.73	10.00	7.81	6.30	6.20	6.12	6.20	6.29	6.25	.....
29	6.68	7.60	8.70	9.95	7.70	6.35	6.20	6.27	6.10	6.20	6.29	.....
30	6.78	.....	9.00	10.00	7.30	6.60	6.18	6.13	6.15	6.15	6.34	.....
31	6.78	.....	8.48	.....	7.28	.....	6.15	6.10	.....	6.20	.....	.....

SINLAHEKIN CREEK NEAR LOOMIS, WASH.

This station was established June 13, 1903, by Charles E. Hewitt. It is located on the main road between Loomis and Conconully, Wash., 3 miles from Loomis and 19 miles from Conconully. The gage is a vertical staff driven into the ground and braced to the gatepost at the northeast corner of R. A. Garrett's yard. Mrs. Mary Garrett, the observer, reads the gage once each day. There is a highway bridge 500 feet north of Mr. Garrett's house, but discharge measurements are made from a plank footbridge near the gage. The initial point for soundings is a 1 by 2 inch iron bar 15 feet long driven flush with the ground at the northeast corner of the main part of Mr. Garrett's house, and 50 feet from the gage. The channel is straight for 20 feet above and for 50 feet below the station. Beyond these points are large bends in the stream. The right bank is low for about 15 feet back from the water's edge. Beyond this point it is not subject to overflow, as it rises more abruptly. The water's edge is covered with shrubbery. The left bank is low grass land, subject to overflow. The bed of the stream is a gravelly clay or loam, and is quite stable. The bench mark is the top of the iron bar used as the initial point for sounding. Its elevation is 11.40 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Sinlahekin Creek near Loomis, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	3.0	2.7	2.9	7.7	6.0	3.6	2.7	2.6	2.5	2.8	2.8
2	2.5	3.0	2.6	3.2	7.5	5.9	3.5	2.6	2.6	2.5	2.8	2.8
3	2.4	3.2	2.6	3.5	7.5	5.8	3.4	2.6	2.5	2.5	2.8	2.8
4	2.4	3.2	2.6	3.5	7.4	5.8	3.4	2.6	2.5	2.5	2.8	2.8
5	2.4	3.3	2.5	3.5	7.3	5.8	3.3	2.6	2.5	2.5	2.8	2.8
6	2.4	3.0	2.4	3.3	6.9	5.7	3.2	2.6	2.5	2.5	2.8	2.7
7	2.5	2.8	2.4	3.0	6.7	5.6	3.2	2.6	2.5	2.5	2.8	2.7
8	2.5	2.8	2.6	2.9	6.7	5.5	3.3	2.6	2.5	2.5	2.8	2.7
9	2.5	2.8	3.0	2.9	6.6	5.3	3.2	2.5	2.5	2.5	2.8	2.7
10	2.6	3.0	2.6	2.9	6.6	5.2	3.2	2.5	2.5	2.6	2.8	2.7
11	2.8	3.5	2.5	3.0	6.6	5.0	3.1	2.5	2.5	3.3	2.8	2.7
12	2.7	4.0	2.5	3.3	6.6	4.8	3.5	2.5	2.5	3.6	2.8	2.7
13	2.6	3.8	2.5	3.8	6.5	4.8	3.0	2.5	2.5	3.0	2.8	2.7
14	2.6	3.7	2.5	4.0	6.6	4.5	3.0	2.5	2.5	2.9	2.8	2.7
15	2.6	3.6	2.5	4.7	6.8	4.5	3.0	2.5	2.5	2.8	2.9	2.7
16	2.6	3.5	2.5	7.3	6.9	4.4	3.2	2.5	2.5	2.8	3.0	2.7
17	2.8	3.4	2.5	7.6	7.0	4.4	3.1	2.5	2.5	2.7	3.0	2.7
18	2.8	3.4	2.4	6.8	7.0	4.5	3.0	2.5	2.5	2.7	2.9	2.7
19	2.5	3.4	2.4	6.7	7.1	5.8	3.0	2.5	2.5	2.7	2.8	2.7
20	2.5	3.0	2.4	6.8	7.3	4.8	2.9	2.5	2.5	2.7	2.8	2.7
21	2.6	3.5	2.4	6.8	7.6	4.6	2.8	2.5	2.5	2.7	2.8	2.7
22	2.6	3.6	2.4	7.2	7.6	4.4	2.8	2.5	2.5	2.7	2.8	2.7
23	2.6	3.6	2.4	7.2	7.5	4.2	2.8	2.5	2.5	2.7	2.8	2.7
24	2.6	3.6	2.4	7.0	7.4	4.1	2.8	2.5	2.5	2.7	2.8	2.7
25	2.7	3.6	2.4	6.7	7.0	4.0	2.8	2.5	2.5	2.7	2.8	2.7
26	2.8	3.7	2.4	6.8	6.7	3.9	2.8	2.5	2.5	2.7	2.8	2.7
27	2.8	3.5	2.4	7.0	6.6	3.8	2.8	2.5	2.5	2.7	2.8	2.7
28	2.8	3.3	2.4	7.7	6.5	3.7	2.7	2.6	2.5	2.7	2.8	2.7
29	2.7	2.8	2.4	(a)	6.4	3.6	2.7	2.7	2.5	2.7	2.8	2.8
30	2.6	.....	2.5	8.0	6.3	3.6	2.7	2.7	2.5	2.7	2.8	2.8
31	2.6	.....	2.7	.....	6.0	.....	2.7	2.6	.....	2.7	.....	2.7

[a] Water above gage.

Rating table for Sinlahekin Creek near Loomis, Wash., from June 13, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	4.5	2.40	11	3.20	34	3.90	62
1.70	5	2.50	13	3.30	37	4.00	66
1.80	5.5	2.60	16	3.40	41	4.10	72
1.90	6	2.70	19	3.50	45	4.20	77
2.00	6.5	2.80	22	3.60	49	4.30	82
2.10	7	2.90	25	3.70	53	4.40	87
2.20	8	3.00	28	3.80	57	4.50	92
2.30	9	3.10	31				

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1903. It is well defined between gage heights 2.40 feet

and 4.10 feet. The table has been extended beyond these limits. Above gage height 3.90 feet the rating curve is a tangent, the difference being 5 per tenth.

Estimated monthly discharge of Sinlahekin Creek near Loomis, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	22	11	15.8	972
February	66	22	39.2	2,255
March	28	11	13.3	818
April	266	25	133	7,914
May	251	166	21.3	1,310
June	166	49	106	6,307
July	49	19	29.4	1,808
August	19	13	14.3	879
September	16	13	13.2	786
October	49	13	19.1	1,174
November	28	22	22.1	1,315
December	22	19	19.2	1,181
The year	266	11	37.2	26,720

JOHNSON CREEK NEAR RIVERSIDE, WASH.

This station was established by T. A. Noble, May 30, 1903. It is located at Sogle's ranch, on the road from Riverside to Conconully, 1 mile from Riverside and 17 miles from Conconully. The equipment consists of a sharp crested weir with an 8-foot opening and vertical sides. Below the level of the crest the weir consists of two 2-inch pine planks, 12 inches wide, securely spiked together. Above the crest on each end are two planks 12 inches wide, which form the ends of the weir. The edges of the crest and ends are one-fourth inch wide and beveled on the downstream side to an angle of 60°. The pool above the weir is 10 feet long, 10 to 15 feet wide, and 1 foot deep below the crest. The water has a fall of about 1 foot after passing the weir and then flows rapidly away.

The depth of water on the crest is determined by a hook gage and vernier reading to thousandths of a foot. The zero on the gage is level with the crest of the weir. Readings are made once each day by S. Sogle. The right bank of the stream is low for 10 feet back from the water's edge and then it rises more abruptly. The left bank is steep and rocky. The bed of the creek is composed of small gravel. Bench mark No. 1 is the top of the fence post opposite the weir. Its elevation is 19.12 feet above gage datum. Bench mark No. 2 is a nail driven into a stake 3 feet northwest of the weir. Its elevation is 0.29

foot above gage datum. The weir was destroyed July 30, 1904, and the station discontinued.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Johnson Creek near Riverside, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	0.38	0.32	0.40	0.62	0.68	0.44	0.45
2	.37	.31	.39	.65	.66	.48	.48
3	.38	.32	.36	.68	.62	.48	.45
4	.38	.32	.40	.74	.63	.47	.42
5	.37	.32	.40	.77	.63	.46	.42
6	.38	.38	.40	.78	.61	.46	.44
7	.39	.38	.45	.71	.65	.46	.44
8	.40	.34	.44	.68	.63	.45	.45
9	.40	.31	.44	.65	.60	.43	.45
10	.41	.31	.45	.69	.61	.43	.46
11	.43	.32	.50	.70	.61	.45	.46
12	.38	.33	.50	.67	.59	.45	.46
13	.39	.34	.51	.67	.55	.44	.46
14	.39	.24	.50	.67	.54	.44	.48
15	.41	.30	.47	.76	.52	.42	.52
16	.44	.34	.46	.78	.52	.43	.52
17	.43	.34	.46	.74	.50	.42	.52
18	.41	.35	.45	.71	.48	.54	.50
19	.32	.38	.45	.78	.47	.56	.49
20	.37	.38	.45	.78	.46	.48	.48
21	.35	.37	.50	.79	.44	.48	.48
22	.36	.38	.52	.79	.45	.47	.48
23	.36	.33	.52	.79	.48	.49	.45
24	.36	.38	.50	.73	.48	.48	.45
25	.34	.37	.49	.72	.49	.47	.44
26	.34	.39	.49	.72	.48	.48	.44
27	.33	.40	.48	.68	.46	.50	.44
28	.32	.40	.51	.64	.47	.51	.45
29	.33	.39	.57	.69	.45	.49	.45
30	.32	.....	.53	.66	.43	.48	[a].45
31	.32	.....	.61	.....	.44	.....	[a].45

[a] Estimated.

Rating table for Johnson Creek near Riverside, Wash., from May 29 to December 31, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.1	0.9	0.4	6.7	0.7	15.3	1.0	26.0
.2	2.4	.5	9.3	.8	18.7	.....	.....
.3	4.4	.6	12.2	.9	22.3	.....	.....

[a] The computations for the rating table were based on the formula for contracted weirs.

Gage heights give directly depth of water over weir.

Estimated monthly discharge of Johnson Creek near Riverside, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	7.7	4.9	6.10	375
February	6.7	3.2	5.47	315
March	12.5	5.8	8.58	528
April	18.4	12.8	15.9	946
May	14.7	7.5	10.4	640
June	11.0	7.2	8.48	505
July	9.9	7.2	8.33	512
The period				3,821

SALMON CREEK NEAR MALOTT, WASH.

This station was established April 11, 1903, by T. A. Noble. It is located opposite R. D. Jones's house, which is on the county road halfway between Malott and Conconully, Okanogan County. It is reached by way of the Great Northern Railway to Wenache, thence by way of the Columbia River steamers to Brewster, and by the Conconully stage from Brewster to Jones's ranch. The gage is vertical and consists of a 1 by 6 inch board graduated to feet and inches, and fastened to a small alder tree on the left bank of the river opposite the house of the observer, R. D. Jones, who reads the gage once each day. Discharge measurements are made from the footbridge just above the gage. The initial point for soundings is a large nail driven in a birch hub, 8 inches in diameter and 2 feet long, 4 feet east of the bridge and 14 feet north of the gage. It is on the left bank, 7 feet from the water's edge at ordinary stages. The channel is straight for 100 feet above and for 200 feet below the station. There are rapids at the bend in the river 100 feet above the station and at another bend 300 feet below the station. The current is swift. The right bank is low and will overflow for about 100 feet, at which point it becomes steep. The left bank is low and may overflow for 200 feet at extreme flood stages. Both banks are without trees or brush with the exception of a fringe of alder at the water's edge. The bed is rocky at the center and sandy along the banks. It is without vegetation except near the banks. The bench mark is the initial point for soundings. Its elevation is 4.58 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Salmon Creek near Malott, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 23	G. H. Bliss	18	28	0.62	0.82	17
July 2	W. W. Schlecht	21	33	1.17	1.12	38

Mean daily gage height, in feet, of Salmon Creek near Malott, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.71	0.67	0.65	0.82	3.12	2.67	1.66	0.84	0.91	0.67	0.82	0.87
2	.93	.75	.58	.87	3.18	2.50	1.56	.85	.94	.71	.83	.85
3	.83	.77	.67	.96	3.17	2.54	1.54	.83	.92	.66	.83	.85
4	.69	.75	.79	1.02	3.00	2.52	1.50	.77	.91	.60	.83	.84
5	.67	.71	.74	1.00	2.34	2.50	1.46	.75	.85	.60	.82	.84
6	.85	.67	.75	1.08	2.44	2.63	1.48	.77	.82	.67	.82	.83
7	.83	.69	.77	1.04	2.54	2.58	1.42	.74	.79	.63	.83	.83
8	.60	.75	.83	1.08	2.58	2.33	1.49	.67	.75	.60	.83	.83
9	.72	.58	.81	1.17	2.59	2.33	1.42	.83	.75	.67	.83	.84
10	.79	.69	.77	1.30	2.57	2.21	1.38	.82	.79	.69	.82	.84
11	.67	.67	.79	1.42	2.54	2.15	1.29	.88	.77	1.33	.81	.83
12	.83	.75	.75	1.54	2.58	2.08	1.29	1.00	.79	1.27	.82	.83
13	.71	.67	.69	1.70	2.60	2.04	1.23	1.04	.75	1.29	.83	.84
14	.81	.77	.75	2.83	2.69	2.08	1.21	1.00	.79	1.00	.83	.84
15	.67	.75	.71	2.53	2.75	2.10	1.19	.99	.77	.96	.94	.85
16	.83	.77	.99	2.09	2.71	2.08	1.23	.96	.75	.88	.98	.84
17	.87	.79	1.00	2.58	2.67	2.06	1.21	.94	.76	.92	1.02	.84
18	.67	.75	.99	2.50	2.71	2.21	1.18	.96	.75	.94	1.00	.83
19	.83	.74	.92	2.54	2.79	2.38	1.17	.92	.69	.87	.92	.83
20	.58	.69	.81	2.67	2.83	2.13	1.09	.96	.74	.83	.92	.82
21	.71	.69	.85	2.75	3.04	2.04	1.08	.94	.77	.85	.91	.80
22	.80	.75	.83	2.96	3.21	1.94	1.04	.93	.71	.91	.92	.79
23	.79	.69	.82	2.75	3.08	1.83	1.00	.94	.75	.83	.90	.75
24	.79	.75	.67	2.75	2.92	1.79	.99	.96	.71	.79	.90	.71
25	.79	.67	.64	2.71	2.75	1.76	.98	.83	.67	.79	.89	.....
26	.73	.71	.62	2.94	2.79	1.75	1.00	.88	.69	.82	.89	.....
27	.75	.73	.67	3.28	2.75	1.72	.92	.83	.67	.83	.88	.....
28	.67	.79	.69	3.58	2.71	1.69	.91	.83	.71	.79	.88	.....
29	.79	.69	.82	3.63	2.67	1.67	.92	.85	.62	.77	.87	.....
30	.71	.....	.75	3.27	2.58	1.64	.90	.88	.58	.79	.86	.....
31	.71	.....	.79	.....	2.59	.....	.88	.92	.....	.81	.....	.....

Rating table for Salmon Creek near Malott, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	11	1.3	57	2.0	166	2.6	292
.7	13	1.4	71	2.1	183	2.7	318
.8	16	1.5	86	2.2	202	2.8	345
.9	20	1.6	102	2.3	222	2.9	373
1.0	27	1.7	118	2.4	244	3.0	401
1.1	35	1.8	134	2.5	267	3.1	429
1.2	45	1.9	150				

The above table is applicable for open-channel conditions only. It is based on discharge measurements made during 1903 and 1904. It is well defined between 0.85 foot and 3.14 feet gage height. It has been extended below 0.85 foot.

Estimated monthly discharge of Salmon Creek near Malott, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	22	11	14.7	904
February	16	11	13.5	777
March	27	11	15.7	965
April	577	17	224.	13,330
May	451	231	332.	20,410
June	310	108	195.	11,600
July	112	19	51.1	3,142
August	30	12	20.0	1,230
September	22	11	15.1	898
October	61	11	20.1	1,236
November	29	16	19.3	1,148
December (1–24)	19	13	17.2	819
The period				56,460

METHOW RIVER NEAR PATEROS, WASH.

Methow River has its source in the Cascade Mountains near the boundary line between the United States and British Columbia, and flows in a southeast direction into Columbia River. The stream is a very rapid one, and is at present used to a considerable extent for irrigation purposes.

The gaging station was originally established May 3, 1903, by T. A. Noble, and was located upon a highway bridge about 1,000 feet above the mouth of the river. The first two measurements were taken from

this bridge. During the summer of 1903 this bridge was washed away, and a temporary bridge, 400 feet farther down stream was used in making the measurement of March 20, 1904.

During the spring of 1904, this bridge was also abandoned because of its temporary nature and the poor section at this point, and a cable station was established about a mile above the mouth of the river where a very good section exists for taking measurements, except at the highest stage of the river. At such times the current at the station becomes too swift to measure, and it is necessary to use a boat farther down the stream, where the backwater from Columbia River retards the current.

The gage is located about 500 feet below the cable, and above any effect of backwater from Columbia River. It is fastened between two pine trees on the left bank. The lower section is inclined and reads from 0 to 10 feet. The upper section is vertical and reads from 10 to 19 feet. Both sections are divided into feet and tenths. All gage heights given below and all discharge measurements are referred to this gage. A secondary gage is in place at the cable to be used by the hydrographer at the time of measurement, to assist in computing areas.

Both banks at the station are high and not liable to overflow. The bed of the stream is covered with small bowlders and gravel and is liable to slight changes. The initial point for soundings is a cross marked "I. P." on rock about 10 feet back of shear legs on left bank.

Bench mark No. 1 is a United States Geological Survey standard iron post in front of Ives Hotel, at Pateros, Wash. Its elevation is 26.05 feet above zero of the gage and 780 feet above sea level. Bench mark No. 2 is the top of a large white stone, marked "B. M.," which is 30 feet northeast of gage board on left bank. Elevation of the highest point is 15.20 feet above gage datum.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Methow River near Pateros, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 20 [a]	G. H. Bliss	66	124	3.82	4.20	474
June 10 [b]	W. G. Steward	250	2,631	2.77	8.80	7,293
July 1	C. M. Hurlburt	245	2,041	3.81	8.60	7,790
July 30 [b]	W. G. Steward	170	534	2.56	5.39	1,368

[a] Made at temporary bridge. [b] Made at new cable station.

Mean daily gage height, in feet, of Methow River near Pateros, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.60	4.30	4.30	4.20	9.00	9.30	8.50	5.30	4.50	4.10	4.15	4.20
2	4.55	4.35	4.30	4.20	8.75	9.25	8.60	5.30	4.50	4.10	4.15	4.20
3	4.50	4.45	4.25	4.25	8.50	9.20	8.20	5.20	4.45	4.10	4.15	4.20
4	4.50	4.50	4.25	4.25	8.40	9.15	8.20	5.15	4.45	4.10	4.15	4.20
5	4.50	4.50	4.25	4.30	8.30	9.30	8.10	5.15	4.45	4.10	4.15	4.20
6	4.50	4.50	4.25	4.35	8.05	9.50	8.10	5.10	4.40	4.10	4.15	4.20
7	4.55	4.50	4.25	4.40	7.85	9.60	8.20	5.10	4.40	4.10	4.15	4.20
8	4.55	4.45	4.25	4.45	7.75	9.20	7.90	5.05	4.35	4.10	4.15	4.20
9	4.55	4.40	4.25	4.50	7.60	8.75	7.60	5.05	4.30	4.10	4.15	4.20
10	4.50	4.40	4.25	4.65	7.60	8.85	7.40	4.95	4.30	4.50	4.15	4.20
11	4.50	4.45	4.25	4.90	7.60	8.50	7.30	4.85	4.30	4.50	4.15	4.20
12	4.50	4.55	4.25	5.40	7.60	8.50	7.20	4.80	4.30	4.40	4.15	4.20
13	4.50	4.50	4.20	6.25	7.65	8.50	6.90	4.80	4.30	4.30	4.15	4.20
14	4.50	4.60	4.20	7.00	7.90	8.50	6.55	4.75	4.25	4.30	4.15	4.25
15	4.55	4.60	4.20	8.20	7.90	8.20	6.40	4.70	4.25	4.30	4.15	4.25
16	4.55	4.55	4.20	8.70	8.00	8.20	6.25	4.70	4.25	4.25	4.20	4.20
17	4.55	4.50	4.20	8.50	8.10	8.15	6.10	4.70	4.20	4.25	4.20	4.20
18	4.55	4.50	4.20	8.30	8.30	9.90	6.00	4.70	4.20	4.25	4.25	4.15
19	4.50	4.45	4.20	8.40	8.50	9.40	5.90	4.65	4.20	4.25	4.20	4.10
20	4.30	4.45	4.20	8.40	9.10	9.10	5.90	4.60	4.15	4.25	4.20	4.05
21	4.30	4.45	4.20	8.50	9.80	8.50	5.90	4.60	4.15	4.20	4.25	4.05
22	4.30	4.40	4.20	8.45	10.00	8.20	5.85	4.55	4.20	4.20	4.30	4.05
23	4.45	4.40	4.20	8.40	11.00	7.10	5.85	4.55	4.25	4.20	4.30	4.05
24	4.40	4.40	4.20	8.15	10.50	7.60	5.80	4.50	4.25	4.15	4.30	4.00
25	4.40	4.35	4.20	8.10	9.50	7.40	5.70	4.40	4.20	4.15	4.30	3.90
26	4.40	4.35	4.20	8.05	9.25	7.80	5.60	4.40	4.20	4.15	4.30	3.85
27	4.40	4.35	4.20	8.45	9.00	8.20	5.60	4.40	4.15	4.15	4.25	4.05
28	4.40	4.35	4.20	9.30	9.20	8.50	5.55	4.40	4.15	4.15	4.25	4.10
29	4.40	4.30	4.20	10.00	9.60	8.50	5.50	4.65	4.10	4.15	4.20	4.15
30	4.30	.....	4.20	9.65	9.50	8.50	5.40	4.60	4.10	4.15	4.20	4.15
31	4.30	.....	4.20	.....	9.30	.....	5.35	4.55	.....	4.15	.....	4.15

Rating table for Methow River near Pateros, Wash., from June 17, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.80	345	5.30	1,250	6.80	3,320	8.40	6,420
3.90	365	5.40	1,360	6.90	3,500	8.60	6,840
4.00	390	5.50	1,475	7.00	3,680	8.80	7,260
4.10	420	5.60	1,595	7.10	3,860	9.00	7,680
4.20	460	5.70	1,720	7.20	4,040	9.20	8,100
4.30	505	5.80	1,850	7.30	4,220	9.40	8,520
4.40	555	5.90	1,980	7.40	4,400	9.60	8,940
4.50	605	6.00	2,110	7.50	4,580	9.80	9,360
4.60	665	6.10	2,240	7.60	4,780	10.00	9,780
4.70	725	6.20	2,370	7.70	4,980	10.20	10,200
4.80	790	6.30	2,510	7.80	5,180	10.40	10,620
4.90	865	6.40	2,670	7.90	5,380	10.60	11,040
5.00	950	6.50	2,830	8.00	5,580	10.80	11,460
5.10	1,045	6.60	2,990	8.20	6,000	11.00	11,880
5.20	1,145	6.70	3,150				

The preceding table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1903 and 1904. The table has been extended beyond these limits. Above gage height 8.00 feet the rating curve is a tangent, the difference being 210 per tenth.

Estimated monthly discharge of Methow River near Pateros, Wash., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
June 17–30	13,140	7,260	10,020	278,300
July	6,630	1,746	3,230	198,600
August	1,707	790	1,129	69,420
September	1,045	665	830	49,390
October	1,145	790	984	60,500
November	1,145	769	942	56,050
December	950	665	790	48,580
The period				760,800
1904.				
January	665	505	588	36,160
February	665	505	578	33,250
March	505	460	469	28,840
April	9,780	460	4,101	244,000
May	11,880	4,780	7,018	431,500
June	9,570	3,860	6,945	413,300
July	6,840	1,305	3,353	206,200
August	1,250	555	806	49,560
September	605	420	496	29,510
October	605	420	463	28,470
November	505	440	460	27,370
December	480	355	439	26,990
The year	11,880	355	2,143	1,555,000

CHELAN RIVER BELOW LAKE CHELAN, WASHINGTON.

The Chelan is a short river, being only about 4 miles in length. It connects Lake Chelan with Columbia River, entering the latter at Chelan Falls. It is valuable principally for the water power that can be developed upon it.

A station, to determine the flow from the lake, was established November 6, 1903, by G. H. Bliss. It is located at the highway bridge 3,000 feet below the outlet of the lake and in the town of Chelan. The gage is a vertical rod 16 feet long attached to the third pile bent

of the northwestern approach to the bridge. It is read once each day by G. L. Richardson. Discharge measurements are made from the downstream side of the new highway bridge, to which the gage is attached. The initial point for soundings is the end vertical on the downstream side of the bridge at the northwest approach. The channel is straight for 50 feet above and for 150 feet below the station. The right bank can not overflow. The left bank is lower than the right, but is not liable to overflow. Both banks are without trees. The bed of the stream is composed of rocks and gravel, free from vegetation, and liable to shift somewhat. The bench mark is a wire spike driven into the root of a large cottonwood tree, which is 40 feet downstream from the northwestern approach to the bridge and 30 feet from the river. The root is on the west side of the tree. The elevation of the bench mark is 11.86 feet above the zero of the gage.

A dam which has been constructed at the foot of the lake by the town of Chelan holds back the flow of water from the lake to some extent during the dry season. This dam is about 3,000 feet above the gage board and bridge described above.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Chelan River below Lake Chelan, Washington, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 24	G. H. Bliss	249	538	2.11	5.95	1,136
May 21	Steward and Murphy	302	1,331	4.45	9.13	5,926
June 11	W. G. Steward	310	1,664	4.88	10.27	8,122
July 31	do	296	1,092	4.05	8.17	4,421
August 22	do	280	773	3.19	7.15	2,571

Mean daily gage height, in feet, of Chelan River below Lake Chelan, Washington, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.80	5.60	5.60	5.80	9.00	10.25	10.10	8.30	5.60	5.60	5.40	5.50
2	5.80	5.60	5.55	5.80	9.00	10.30	10.20	8.25	5.40	5.60	5.40	5.50
3	5.75	5.60	5.50	5.75	8.95	10.30	10.30	8.20	5.40	5.60	5.35	5.50
4	5.70	5.55	5.50	5.75	8.90	10.30	10.35	8.15	5.40	5.60	5.40	5.50
5	5.50	5.50	5.50	5.75	8.90	10.35	10.40	8.10	5.45	5.60	5.40	5.50
6	5.60	5.00	5.50	5.75	8.75	10.50	10.50	8.00	6.45	5.60	5.35	5.50
7	5.65	5.45	5.50	5.75	8.65	10.65	10.40	8.00	6.40	5.60	5.35	5.50
8	5.60	5.40	5.55	5.75	8.60	10.60	10.50	7.95	6.45	5.55	5.40	5.50
9	5.70	[a] 5.80	5.55	5.75	8.60	10.50	10.45	7.90	6.40	5.50	5.40	5.45
10	5.70	5.80	5.60	5.75	8.55	10.40	10.55	7.90	6.50	5.50	5.45	5.45
11	5.65	5.75	5.65	5.85	8.50	10.30	10.45	7.80	6.45	5.45	5.45	5.40
12	5.65	5.75	5.60	6.10	8.45	10.20	10.50	7.75	6.40	5.45	5.50	5.40

[a] Opening made in dam.

Mean daily gage height, in feet, of Chelan River below Lake Chelan, Washington, for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
13	5.65	5.70	5.60	6.30	8.40	10.10	10.45	7.70	6.40	5.40	5.50	5.40
14	5.70	5.70	5.60	6.70	8.40	10.00	10.20	7.60	6.40	[a] 5.80	5.45	5.45
15	5.65	5.65	5.60	6.90	8.45	10.05	10.00	7.50	6.40	5.80	5.50	5.50
16	5.60	5.60	5.90	7.20	8.50	10.10	9.80	7.50	6.35	5.80	5.50	5.50
17	5.60	5.60	5.85	7.50	8.60	10.10	9.60	7.40	6.35	5.80	5.50	5.45
18	5.75	5.60	6.20	7.65	8.65	10.30	9.40	7.40	[a] 6.15	5.80	5.45	5.45
19	5.70	5.60	6.20	7.80	8.80	10.40	9.20	7.40	6.15	5.75	5.45	5.45
20	5.60	5.60	6.25	7.90	8.90	10.40	9.10	7.30	6.15	5.75	5.50	5.45
21	5.55	5.60	6.25	8.10	9.00	10.40	8.90	7.20	6.15	5.70	5.50	5.45
22	5.65	5.70	6.15	8.20	9.30	10.35	8.85	7.15	6.10	5.70	5.50	5.45
23	5.60	5.50	6.10	8.25	9.55	10.25	8.85	7.10	6.10	5.70	5.50	5.45
24	5.65	5.50	5.90	8.20	9.80	10.00	8.75	7.05	6.00	5.65	5.50	5.40
25	5.70	5.60	5.90	8.25	9.90	10.00	8.65	7.00	6.05	5.65	5.55	5.40
26	5.70	5.65	5.90	8.30	10.00	9.90	8.20	6.90	6.00	5.60	5.55	5.35
27	5.65	5.70	5.90	8.35	10.00	9.80	8.10	[b] 6.40	5.60	5.55	5.55	5.40
28	5.60	5.65	5.85	8.50	10.00	9 80	8.40	6.00	5.60	5.50	5.50	5.40
29	5.60	5.60	5.80	8.85	10.00	9.90	8.40	5.40	5.60	5.45	5.50	5.35
30	5.60	.....	5.80	8.95	10.10	9.95	8.30	5.50	5.60	5.45	5.50	5.35
31	5.60	.....	5.75	.....	10.15	.....	8.30	5.60	.....	5.40	.....	5.35

[a] Dam partly opened. [b] Dam closed.

Rating table for Chelan River below Lake Chelan, Washington, from November 6, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.30	655	6.50	1,650	7.70	3,455	8.90	5,525
5.40	715	6.60	1,770	7.80	3,625	9.00	5,705
5.50	780	6.70	1,900	7.90	3,795	9.20	6,080
5.60	850	6.80	2,040	8.00	3,965	9.40	6,460
5.70	930	6.90	2,190	8.10	4,135	9.60	6,840
5.80	1,010	7.00	2,340	8.20	4,305	9.80	7,220
5.90	1,090	7.10	2,490	8.30	4,475	10.00	7,600
6.00	1,170	7.20	2,640	8.40	4,645	10.20	7,980
6.10	1,255	7.30	2,800	8.50	4,815	10.40	8,360
6.20	1,345	7.40	2,960	8.60	4,985	10.60	8,740
6.30	1,440	7.50	3,120	8.70	5,165	10.80	9,120
6.40	1,540	7.60	3,285	8.80	5,345	11.00	9,500

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1903 and 1904. It is well defined between gage heights 5.90 feet and 10.50 feet. The table has been extended beyond these limits. Above gage height 9.00 feet the rating curve is a tangent, the difference being 190 per tenth.

Estimated monthly discharge of Chelan River below Lake Chelan, Washington, for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
November 6–30	1,782	1,300	1,525	90,740
December	2,310	1,010	1,250	76,860
1904.				
January	1,010	780	893	54,910
February	1,010	500	856	49,240
March	1,390	780	997	61,300
April	5,615	970	2,686	159,800
May	7,885	4,545	5,865	360,600
June	8,835	7,220	8,008	476,500
July	8,645	4,135	6,776	416,600
August	4,475	715	2,982	183,400
September	1,650	715	1,235	73,490
October	1,010	715	863	53,060
November	815	685	755	44,930
December	780	685	742	45,620
The year	8,835	500	2,722	1,979,000

WENACHE RIVER AT CASHMERE, WASH.

This station was established July 26, 1904, by W. G. Steward. It is located at the highway bridge just north of the town of Cashmere, Wash. A plain staff gage, graduated to feet and tenths, is nailed vertically to the downstream edge of the south face of the middle pier. It is read once each day by A. C. Jones. Discharge measurements are made from the downstream side of the two-span bridge to which the gage is attached. The initial point for soundings is a bolt head in the southeast corner of the bridge, marked zero. The point is identical with bench mark No. 2. The channel is curved for about 800 feet above and below the station, and the current is swift. The right bank is high, gravelly and rocky, lined with timber and bushes, and not liable to overflow. The left bank is not high, but overflows only in extremely high water. The bed of the stream is covered with small rounded bowlders and cobblestones. It is free from vegetation and permanent. The channel is divided by the pier into two channels. The bridge is located about midway of a long sweeping curve. The water is quite swift, especially at the middle of the south span, which makes sounding at this point difficult, except with heavy weight and small wire.

Bench mark No. 1 is the head of an 8-penny nail driven into a timber at the southeast corner of the middle pier. Its elevation is 12.98 feet above the zero of the gage. Bench mark No. 2 is a bolt head at the southeast corner of the bridge, identical with the initial point. Its elevation is 16.63 feet above the zero of the gage. Bench mark No. 3 is a railroad spike driven into a telephone pole at the left end of the bridge. Its elevation is 10.91 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurement of Wenache River at Cashmere, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 26	W. G. Steward	197	1,174	3.22	3.88	3,646

Mean daily gage height, in feet, of Wenache River at Cashmere, Wash., for 1904.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		3.40	2.20	1.70	1.20	2.30
2		3.40	2.10	1.70	1.30	2.30
3		3.40	2.00	1.60	1.30	2.20
4		3.30	2.00	1.60	1.30	2.10
5		3.30	2.00	1.50	1.30	2.00
6		3.20	1.90	1.40	1.30	1.90
7		3.20	1.90	1.40	1.30	1.90
8		3.20	1.90	1.30	1.10	1.80
9		3.20	2.00	1.30	1.20	1.80
10		3.10	2.00	1.20	1.30	1.80
11		2.90	1.90	1.80	1.30	1.80
12		2.70	1.90	2.00	1.30	1.70
13		2.60	1.90	1.80	1.30	1.70
14		2.60	1.70	1.60	1.30	1.80
15		2.60	1.70	1.50	1.30	2.10
16		2.60	1.60	1.40	1.40	2.20
17		2.50	1.60	1.40	2.00	2.20
18		2.50	1.60	1.40	1.80	2.30
19		2.40	1.60	1.30	1.80	2.20
20		2.40	1.60	1.30	1.90	2.30
21		2.30	1.50	1.30	2.20	2.30
22		2.20	1.50	1.40	2.40	2.20
23		2.10	1.60	1.30	2.60	2.20
24		2.05	1.60	1.30	2.40	2.10
25		2.00	1.50	1.20	2.20	1.90
26		2.00	1.50	1.20	2.10	1.90
27	3.90	2.00	1.50	1.20	2.10	1.80
28	3.90	2.00	1.40	1.20	2.20	1.80
29	3.70	2.40	1.40	1.20	2.50	1.80
30	3.50	2.40	1.60	1.20	2.40	1.80
31	3.40	2.30	.....	1.20	.....	1.80

CRAB CREEK AT WILSON CREEK, WASH.

This station was established March 18, 1904, by Charles E. Hewitt. It is located at a wagon bridge one-fourth mile west of the Great Northern Railroad depot at Wilson Creek, Wash., and 300 feet south of the railroad. Discharge measurements are made from the upstream side of the bridge. The gage is a 6-inch board 13 feet long, graduated to feet and half tenths, and attached to the west end of the first pier from the north end of the bridge. The initial point for sounding is a nail in a 2 by 4 inch stake 94 feet south of the face of the south abutment of the bridge and 5 feet east of the road. The channel is straight for one-fourth mile above and 50 feet below the station. The right bank is low and overflows at extreme high water. The left bank is high and not liable to overflow. The bed of the stream is mud and gravel and is fairly permanent. The current is swift. The stream is divided into five channels at high water and two channels at ordinary stages. The bench mark is the top of a stone 5 feet east of the road and 13 feet south of the initial point. Its elevation is 18.22 feet above gage datum. This station was abandoned June 26, 1904.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Crab Creek at Wilson Creek, Washington, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 18	C. E. Hewett	81	308	2.55	4.86	785
April 29	W. G. Steward	50	196	1.14	3.95	223
June 16	do		266	1.32	3.77	345

Mean daily gage height, in feet, of Crab Creek at Wilson Creek, Washington, for 1904.

Day.	March.	April.	May.	June.	Day.	March.	April.	May.	June.
1		4.70	4.20	3.00	17		4.25	3.80	3.75
2		5.05	4.20	4.35	18		4.25	3.75	3.70
3		4.80	4.60	4.30	19	5.00	4.25	3.75	3.80
4		4.85	4.60	4.25	20	4.97	4.20	3.70	3.70
5		4.89	4.60	3.00	21	4.95	4.21	3.70	3.70
6		5.00	4.60	3.00	22	4.90	4.20	3.70	3.65
7		4.95	4.60	3.95	23	4.86	4.21	3.00	3.65
8		4.85	4.60	3.90	24	4.86	5.20	3.55	3.60
9		4.70	4.60	3.85	25	4.85	5.15	3.55	3.55
10		4.55	4.50	3.80	26	4.83	5.15	3.55	
11		4.57	4.20	3.75	27	4.70	4.00	3.50	
12		4.45	4.15	3.80	28	4.65	5.10	3.50	
13		4.40	4.10	3.75	29	4.60	4.00	3.35	
14		4.35	4.05	3.75	30	4.80	4.00	3.35	
15		4.30	3.00	3.70	31	4.74		3.30	
16		4.24	3.85	3.75					

YAKIMA RIVER NEAR MARTIN, WASH.

Lake Keechelus is the uppermost of the three lakes forming the source of Yakima River. At the mouth a good dam site exists and by the construction of a dam a considerable portion of the flow of the Yakima, at this point, can be stored and used for irrigation in the lower Yakima Valley during the dry season.

A gaging station was established October 18, 1903, by G. H. Bliss, 1,000 feet below the outlet of Lake Keechelus and 800 feet below the dam of the Cascade Lumber Company. It is 4 miles northwest of Martin, Wash. The original gage was in two sections and was located on the right bank just above the cable. The lower inclined section read from 5 to 7 feet. The upper vertical section read from 7 to 13 feet. Observations were taken daily from this gage until November 14, 1903, on which date the gage was destroyed by the caving of the river bank. Observations were then discontinued until January 28, 1904, when a new vertical gage, No. 2, was installed by the Yakima Development Company, at a point 75 feet above the location of the old gage, and readings were resumed by the United States Geological Survey. This gage is in present use. It is a vertical rod, fastened to an overhanging tree, and is divided into feet and tenths. The gage is read daily by Christian Hansen, a trapper, living at the foot of the lake. Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The cable has a total span of 200 feet. The initial point for soundings is the north face of the tree on the south, or right, bank, to which the cable is fastened. The channel is straight for 500 feet above and for 350 feet below the station. Both banks are high, not liable to overflow, and are heavily timbered. The current is swift. There is but one channel at all stages. The bed of the stream is composed of gravel, free from vegetation, and permanent.

Bench mark No. 1 was destroyed with the original gage. Bench mark No. 2 is the top of a spike in the root on the north side of a large cedar tree 50 feet south and 50 feet west of the gage. Its elevation is 21.59 feet above the zero of gage No. 2. Bench mark No. 3 is a nail in the base of a 48-inch fir tree on the right bank, 25 feet above the cable, and 50 feet from the river. The tree is blazed and marked "B. M." The elevation of the bench mark is 25.22 feet above the datum of gage No. 2 which is 0.07 foot higher than that of gage No. 1.

The observations at this station during 1904 were made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River near Martin, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 13	G. F. Harley	117	288	1.90	8.15	543
June 15	do	119	365	2.27	8.88	827
July 21	do	116	208	1.17	7.25	244
August 4	do	106	175	.77	6.88	135
September 20	do	104	122	.48	6.34	58

Mean daily gage height, in feet, of Yakima River near Martin, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	7.10	6.90	6.90	8.65	8.90	8.40	6.90	6.50	6.40	6.50	8.00
2	.....	7.00	6.90	6.90	8.45	9.00	8.40	6.90	6.50	6.40	6.50	7.90
3	.....	7.00	6.80	6.80	8.35	9.10	8.30	6.90	6.50	6.40	6.50	7.70
4	.....	7.00	6.80	6.80	8.25	9.30	8.20	6.90	6.40	6.40	6.50	7.60
5	.....	7.00	6.90	6.90	8.15	9.40	8.20	6.80	6.40	6.40	6.50	7.50
6	.....	7.00	6.90	6.90	8.10	9.40	8.20	6.80	6.40	6.40	6.50	7.40
7	.....	7.00	6.90	6.90	8.10	9.40	8.10	6.80	6.40	6.30	6.50	7.30
8	.....	7.00	6.95	6.90	8.05	9.20	8.00	6.80	6.40	6.40	6.50	7.20
9	.....	6.95	7.00	6.90	8.00	8.80	7.90	6.80	6.40	6.40	6.50	7.20
10	.....	6.90	7.05	7.00	8.00	8.80	7.80	6.70	6.40	6.40	6.50	7.10
11	.....	6.90	7.10	7.15	7.90	8.70	7.75	6.70	6.40	6.40	6.50	7.10
12	.....	6.90	7.10	7.55	8.20	8.55	7.70	6.70	6.40	6.40	6.50	7.10
13	.....	6.90	7.10	8.10	8.20	8.60	7.60	6.65	6.40	6.40	6.50	7.10
14	.....	6.90	7.10	8.60	8.70	8.70	7.45	6.60	6.40	6.40	6.50	7.20
15	.....	6.90	7.10	9.00	8.60	8.80	7.40	6.60	6.40	6.40	6.50	7.40
16	.....	6.90	7.05	9.00	8.60	8.90	7.30	6.60	6.40	6.50	6.60	7.60
17	.....	6.90	7.00	8.80	8.55	8.80	7.30	6.60	6.40	6.50	6.75	8.00
18	.....	6.85	7.00	8.65	8.55	9.00	7.30	6.60	6.40	6.50	6.80	8.10
19	.....	6.80	7.00	8.60	8.70	9.10	7.30	6.60	6.30	6.50	6.95	8.20
20	.....	6.80	7.00	8.60	8.80	8.85	7.30	6.60	6.30	6.50	7.30	8.30
21	.....	6.90	7.00	8.65	8.95	8.75	7.20	6.50	6.30	6.50	7.85	8.15
22	.....	6.90	6.90	8.60	9.20	8.60	7.25	6.50	6.30	6.50	8.15	8.00
23	.....	7.00	6.90	8.50	9.40	8.45	7.20	6.50	6.30	6.50	8.20	7.90
24	.....	7.00	6.90	8.30	9.30	8.25	7.10	6.50	6.30	6.50	8.00	7.75
25	.....	6.90	6.90	8.15	9.10	8.20	7.10	6.50	6.30	6.50	7.90	7.60
26	.....	6.90	6.80	8.15	9.00	8.10	7.10	6.50	6.30	6.50	7.90	7.50
27	.....	6.25	6.80	8.35	9.00	8.20	7.00	6.50	6.30	6.50	7.85	7.40
28	7.20	6.90	6.80	8.70	9.00	8.20	7.00	6.50	6.30	6.50	8.10	7.30
29	7.20	6.90	6.90	9.00	9.10	8.30	7.00	6.50	6.40	6.50	8.10	7.20
30	7.10	.....	6.90	8.95	9.10	8.40	7.00	6.50	6.40	6.40	8.00	7.20
31	7.10	.....	6.90	.....	9.10	.....	6.90	6.50	.....	6.50	.....	7.20

Rating table for Yakima River, near Martin, Wash., from January 28 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.30	51	7.30	249	8.20	566	9.10	920
6.40	63	7.40	281	8.30	604	9.20	960
6.50	76	7.50	315	8.40	642	9.30	1,000
6.60	90	7.60	349	8.50	680	9.40	1,040
6.70	107	7.70	383	8.60	720	9.50	1,080
6.80	127	7.80	418	8.70	760	9.60	1,120
6.90	148	7.90	454	8.80	800	9.70	1,160
7.00	170	8.00	490	8.90	840	9.80	1,200
7.10	194	8.10	528	9.00	880	9.90	1,240
7.20	220						

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is well defined between gage heights 6.36 feet and 8.88 feet. The table has been extended beyond these limits. Above gage height 8.50 feet the rating curve is a tangent, the difference being 40 per tenth.

Estimated monthly discharge of Yakima River near Martin, Wash., for 1904.

[Drainage area, 56 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Second-feet per square mile.	Depth in inches.
	Maximum.	Minimum.	Mean.			
February	194	127	156	8,973	2.79	3.01
March	194	127	159	9,777	2.84	3.27
April	880	127	499	29,690	8.91	9.94
May	1,040	454	733	45,070	13.1	15.1
June	1,040	528	785	46,710	14.0	15.6
July	642	148	339	20,840	6.05	6.98
August	148	76	103	6,333	1.84	2.12
September	76	51	58.6	3,487	1.05	1.17
October	76	51	69.4	4,243	1.24	1.43
November	566	76	230	13,680	4.11	4.59
December	604	194	339	20,840	6.05	6.98
The period				209,600		

YAKIMA RIVER AT EASTON, WASH.

This station was established May 12, 1904, by G. H. Bliss. It is located at Easton, Wash., three-eighths of a mile below the Cascade Lumber Company's dam, at the bridge on the road leading from

Easton to Kachess Lake. A vertical staff gage, graduated to feet and tenths, is nailed to a stump on the left bank, 20 feet below the bridge. It is read once each day by W. W. Johnson. Discharge measurements are made from the downstream side of the highway bridge. The initial point for soundings is a point marked by a circle and cross on the top of the downstream railing 12 feet north of the pier on the left bank. The channel is straight for about 400 feet above and 700 feet below the station, and the water is swift at medium and high stages. The right bank is high, sparsely wooded, and not liable to overflow. The left bank is low, sparsely wooded, and overflows only at extreme high water. The bed of the stream is composed of clean gravel, and is shifting. There is but one channel, which is broken at higher stages by the piling supports of the trestle approaches at either end. There is a shifting gravel bar on the right side of the channel. Diagonal currents interfere with the accuracy of measurements. The bench mark is the top of the case of the steel and concrete pier at the left end on the downstream side of the bridge. Its elevation is 19.39 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River at Easton, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 12	G. F. Harley	148	384	3.70	6.95	1,417
June 14	do	173	428	4.36	7.35	1,868
July 12	do	140	219	3.27	5.74	717
July 21	do	136	169	2.98	5.06	502
August 4	do	125	119	2.79	4.45	332
August 24	do	122	80	2.33	3.86	186

Mean daily gage height, in feet, of Yakima River at Easton, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		7.75	6.40	4.70	4.40	4.20	3.90
2		8.00	6.30	4.60	4.40	4.40	3.90
3		7.90	6.40	4.50	4.40	4.30	3.90
4		7.90	6.70	4.80	4.35	4.40	3.90
5		8.05	6.70	4.50	4.40	4.30	3.80
6		8.10	6.60	4.50	4.40	4.25	3.80
7		7.90	6.50	4.50	4.40	4.25	3.80
8		7.70	6.30	4.30	4.40	4.25	3.80
9		7.60	5.90	4.50	4.40	4.25	3.80
10		7.50	5.80	4.30	4.40	4.30	3.80
11		7.60	5.80	4.50	4.40	4.30	3.80
12	6.95	7.25	5.70	4.50	4.45	4.20	3.90

Mean daily gage height, in feet, of Yakima River at Easton, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
13	7.00	7.10	5.60	4.50	4.30	4.20	3.90
14	7.40	7.50	5.40	4.50	4.30	4.20	3.90
15	7.50	7.30	5.50	4.50	4.40	4.20	3.80
16	7.40	7.30	5.30	4.40	4.35	4.20	3.80
17	7.10	7.25	5.40	4.40	4.30	4.20	3.90
18	6.70	7.70	5.30	4.00	4.40	4.20	3.95
19	6.70	7.35	5.20	4.00	4.30	4.10	4.10
20	6.70	7.60	5.20	4.00	3.80	4.10	4.85
21	7.20	7.50	5.20	4.00	3.90	4.00	5.30
22	7.70	7.10	5.00	4.20	4.40	4.20	5.80
23	8.00	6.90	5.00	4.30	4.40	4.00	5.90
24	7.90	6.70	4.90	3.85	4.40	3.90	5.90
25	7.50	6.50	4.90	4.20	4.40	3.95	5.80
26	7.70	6.30	4.90	4.30	4.40	4.00	5.80
27	7.70	6.40	4.90	4.40	4.40	4.00	5.80
28	7.80	6.20	4.80	4.40	4.40	3.90	6.20
29	7.70	6.20	4.90	4.50	4.40	3.90	(a)
30	7.80	6.20	4.70	4.40	4.40	3.90	.....
31	7.80	.....	4.70	4.40	.....	3.90	.....

[a] Gage washed out.

Rating table for Yakima River at Easton, Wash., from May 12 to November 28, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.90	195	5.00	484	6.00	814	7.00	1,490
4.00	220	5.10	512	6.10	862	7.10	1,590
4.10	246	5.20	540	6.20	910	7.20	1,695
4.20	272	5.30	572	6.30	966	7.30	1,805
4.30	298	5.40	604	6.40	1,022	7.40	1,920
4.40	324	5.50	636	6.50	1,086	7.50	2,040
4.50	350	5.60	668	6.60	1,154	7.60	2,160
4.60	376	5.70	700	6.70	1,230	7.70	2,290
4.70	402	5.80	736	6.80	1,310	7.80	2,420
4.80	428	5.90	774	6.90	1,395	7.90	2,550
4.90	456						

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 3.86 feet and 7.35 feet. The table has been extended beyond these limits. Above gage height 7.60 feet the rating curve is a tangent, the difference being 130 per tenth.

Estimated monthly discharge of Yakima River at Easton, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 12–31	2,680	1,230	1,974	78,310
June	2,810	910	1,867	111,100
July	1,230	402	690	42,430
August	428	185	316	19,430
September	337	175	311	18,510
October	324	195	257	15,800
November 1–28	910	175	357	19,830
The period				305,400

YAKIMA RIVER NEAR NORTH YAKIMA, WASH.

This station was established May 5, 1904, by G. H. Bliss. It is located at the highway bridge, 2¼ miles north of North Yakima, Wash., one-fourth mile above the confluence of Yakima and Naches rivers, and 300 feet east of the bridge of the Northern Pacific Railway Company. A plain staff gage is fastened vertically to the south side of the pier at the right end of the 4-span highway bridge. The gage is read once each day by Patrick Gallagher. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The initial point for soundings is a point marked zero on the top of railing near the right end of the bridge, downstream side. The channel is straight for about 800 feet above and 600 feet below the station. The current is sluggish at low stages. Both banks are low, partly wooded, and subject to overflow during high water. The bed of the stream is composed of gravel and sand, free from vegetation and stable. There is one channel at all stages, broken by 3 bridge piers. The bench mark is the top of the shoe plate on the lower side of the bridge above the pier nearest the right bank. Its elevation is 16.64 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 5	G. F. Harley	217	1,600	4.21	6.83	6,740
July 13	do	201	1,090	2.39	4.40	2,610
July 25	J. C. Dry	188	850	1.60	3.30	1,360
July 30	G. F. Harley	187	830	1.35	3.10	1,123
August 17	J. C. Dry	156	727	0.77	2.40	556
September 1	do	156	725	0.61	2.32	444

Mean daily gage height, in feet, of Yakima River near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	7.20	5.20	3.10	2.30	2.40	2.40
2	.....	7.00	5.20	3.00	2.30	2.40	2.40
3	.....	7.00	.....	3.00	2.30	2.40	2.40
4	.....	7.10	5.30	3.00	.....	2.40	2.40
5	.....	.....	5.40	2.90	2.30	2.50	2.40
6	.....	7.50	5.30	2.90	2.30	2.50	.....
7	.....	7.60	5.20	.....	2.20	2.50	2.40
8	.....	7.10	5.10	2.80	2.20	2.50	2.40
9	6.00	6.70	5.00	2.70	2.20	2.50	2.40
10	5.90	6.30	.....	2.70	2.20	2.50	2.40
11	5.80	6.90	4.70	2.60	.....	2.50	2.40
12	5.80	.....	4.50	2.60	2.20	2.60	2.40
13	5.90	5.70	4.40	2.60	2.20	2.60	.....
14	6.30	5.70	4.30	2.60	2.20	2.60	2.40
15	.....	5.90	4.20	2.50	2.20	2.60	2.40
16	6.80	6.10	4.10	2.50	2.10	2.60	2.40
17	6.80	6.30	.....	2.50	2.10	2.60	2.40
18	6.80	6.50	3.80	2.40	.....	2.60	2.40
19	6.90	.....	3.70	2.40	2.10	2.60	2.40
20	6.90	6.40	3.60	2.40	2.10	2.60	.....
21	7.10	6.30	3.50	.....	2.10	2.50	2.90
22	.....	6.10	3.40	2.30	2.10	2.50	3.90
23	8.10	5.90	3.40	2.30	2.10	.....	3.60
24	8.40	5.60	.....	2.30	2.10	2.50	3.90
25	7.90	5.30	3.30	2.30	.....	2.50	3.70
26	7.50	.....	3.30	2.30	2.30	2.50	3.70
27	7.20	5.20	3.30	2.30	2.30	2.50	.....
28	7.10	5.10	3.20	.....	2.40	2.40	3.80
29	.....	5.00	3.20	2.30	2.40	2.40	3.90
30	7.30	5.10	3.10	2.30	2.40	.....	4.00
31	7.30	.....	.....	2.30	.....	2.40	.....

NOTE.—Observations were made during irrigating season only.

Rating table for Yakima River near North Yakima, Wash., from May 9 to November 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	210	3.30	1,342	4.60	2,916	5.90	5,004
2.10	285	3.40	1,445	4.70	3,059	6.00	5,190
2.20	362	3.50	1,550	4.80	3,204	6.20	5,562
2.30	441	3.60	1,658	4.90	3,351	6.40	5,934
2.40	522	3.70	1,769	5.00	3,500	6.60	6,306
2.50	605	3.80	1,883	5.10	3,651	6.80	6,678
2.60	690	3.90	2,000	5.20	3,805	7.00	7,050
2.70	777	4.00	2,120	5.30	3,962	7.20	7,422
2.80	866	4.10	2,243	5.40	4,124	7.40	7,794
2.90	957	4.20	2,370	5.50	4,290	7.60	8,166
3.00	1,050	4.30	2,501	5.60	4,461	7.80	8,538
3.10	1,145	4.40	2,636	5.70	4,637	8.00	8,910
3.20	1,242	4.50	2,775	5.80	4,818	8.50	9,840

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 2.50 feet and 4.50 feet. The table has been extended beyond these limits. Above gage height 5.80 feet the rating curve is a tangent, the difference being 186 per tenth.

Estimated monthly discharge of Yakima River near North Yakima, Wash., for 1904.[a]

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 9–31	9,654	4,818	6,896	314,600
June	8,166	3,500	5,705	339,500
July	4,124	1,145	2,431	149,500
August	1,145	441	663	40,770
September	522	285	376	22,370
October	690	522	608	37,380
November	2,120	522	955	56,830
The period				961,000

[a] Discharge for missing gage heights interpolated.

YAKIMA RIVER NEAR YAKIMA, WASH.

Yakima River enters Columbia River just above the town of Pasco. The first measurement of the river was made at this point on August 14, 1893. At that time there was an old vertical river rod attached to

the central pier of the bridge. As the foot of this gage at low water was covered by rock and could not be read, an inclined gage was put in position at the west end of the county bridge. This consisted of two pieces of timber, having a total length of 24 feet. These were firmly secured to timbers, bedded, and loaded with rock. The gage rod was painted white and lettered in vertical feet and tenths. After this new gage was located it was ascertained that the readings on the old gage would be 1.13 feet higher than on the new. The zero of this new gage was 19.02 feet below the top of the rail of the Northern Pacific Railroad immediately west of the west end of the bridge, which was about 40 feet from the gage. The high-water mark at that time showed that a flood had risen to 8.80 feet on the old gage. Readings at this point were begun on October 2, 1893, and continued during the following winter and spring until May 19, 1894. Owing to the destruction of the gage by floods the station was for a time abandoned.

During August, 1895, Arthur P. Davis visited the locality and found that the section was not favorable for making discharge measurements. He accordingly selected the present station, which is located at Union Gap, 2 miles below Yakima, Wash., and 1,000 feet below the highway bridge. It is about 3 miles above the intake of the Sunnyside canal. The station is of value, as it is the only point near the large irrigated area above and below which is unaffected by the taking out of water in irrigating canals. The gage rod is inclined and is attached to a willow stump and post set in the ground. It is read once each day by Hugh Kennedy, the section foreman. Discharge measurements are made by means of a cable, car, and tagged wire 150 feet above the gage and 1,000 feet below the highway bridge. The initial point for soundings is a cross chiseled on a rock 2.7 feet from the cable support on the right bank. The channel is straight for 1,000 feet above and below the station. The current has a moderate velocity. The right bank is high, not liable to overflow, and is covered with sagebrush. The left bank is a low gravel bar which overflows during extreme high water. The bed of the stream is composed of gravel, free from vegetation and permanent. There is one channel at low water and two channels at ordinary and flood stages. Bench mark No. 1 is the top of a large bowlder between two other bowlders 43 feet north of the gage and 6.5 feet east of the fence. Its elevation is 17.52 feet above the zero of the gage. Bench mark No. 2 is the top of a large bowlder under the railroad fence 12 feet north of the gage. Its elevation is 21.29 feet above the zero of the gage. The elevation of the initial point for soundings is 17.45 feet above the zero of the gage. The bench marks are marked "B. M." with black paint.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River near Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
May 9	G. F. Harley	343	2,140	4.29	7.85	9,180
May 16	do	353	2,530	5.33	8.85	13,490
May 19	Murphy and Bliss	349	2,570	5.48	8.87	14,080
May 24	G. F. Harley	468	3,310	6.40	10.40	21,180
May 25	do	457	3,050	6.07	10.00	18,560
June 29	do	337	1,850	4.17	7.40	7,750
July 18	do	241	1,340	2.51	5.78	3,370
July 23	do	239	1,273	2.26	5.48	2,873
August 1	do	237	1,131	1.78	4.87	2,015
August 25	do	234	865	1.05	3.79	910

Mean daily gage height, in feet, of Yakima River near Yakima, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.50	5.50	4.90	5.70	10.20	9.40	7.60	4.90	3.80	3.90	3.80	6.00
2	5.50	5.50	4.90	5.90	9.70	9.20	7.60	4.90	3.80	3.90	3.80	5.90
3	5.30	5.40	4.90	6.50	9.40	9.50	7.40	4.80	3.80	3.90	3.80	5.90
4	5.30	5.40	4.90	7.20	9.30	9.00	7.40	4.80	3.80	3.90	3.80	5.60
5	5.30	5.40	4.80	7.10	9.00	9.10	7.60	4.70	3.80	3.90	3.80	5.40
6	5.00	5.30	5.20	7.80	8.90	9.40	7.60	4.70	3.75	3.90	3.80	5.40
7	5.10	5.30	5.60	7.50	8.60	9.40	7.60	4.60	3.70	3.90	3.80	5.30
8	5.20	5.30	7.30	7.30	8.00	9.00	7.40	4.50	3.70	3.90	3.90	5.20
9	5.20	5.30	6.10	7.50	7.80	8.60	7.30	4.50	3.70	3.90	3.90	5.20
10	5.20	5.10	6.10	8.70	7.80	8.40	7.00	4.30	3.70	3.90	3.90	5.00
11	5.30	5.10	6.80	9.30	7.90	8.00	6.90	4.30	3.70	4.00	3.90	5.00
12	5.40	5.00	6.40	10.10	8.00	7.90	6.90	4.20	3.70	4.00	3.90	5.00
13	5.40	4.90	6.30	10.80	8.00	7.60	6.70	4.20	3.70	4.00	3.90	4.90
14	5.90	5.00	6.10	11.50	8.40	7.70	6.30	4.10	3.70	4.10	3.90	4.90
15	6.00	5.10	6.00	12.20	8.60	8.00	6.10	4.10	3.70	4.10	3.90	5.00
16	6.70	5.10	6.00	12.10	8.60	8.30	6.00	4.10	3.70	4.00	3.85	5.40
17	6.70	5.00	5.90	11.50	8.80	8.50	6.00	4.00	3.65	4.00	3.85	5.50
18	6.50	5.00	5.70	10.70	8.80	8.70	5.90	4.00	3.65	4.00	4.00	5.50
19	6.50	5.00	5.70	10.50	8.90	8.60	5.90	4.00	3.65	4.00	4.00	5.50
20	6.30	5.00	5.80	10.50	9.00	8.40	5.80	3.9	3.65	4.00	4.10	5.60
21	6.30	5.00	5.80	11.30	9.20	8.30	5.70	3.90	3.65	4.00	5.80	5.70
22	6.10	5.00	5.90	10.50	10.00	8.20	5.60	3.90	3.65	4.00	6.30	5.80
23	6.10	5.40	5.70	10.50	10.60	8.20	5.60	3.80	3.70	3.90	6.30	5.80
24	6.00	5.20	5.70	9.70	10.50	8.00	5.50	3.80	3.80	3.90	6.30	5.80
25	6.00	5.20	5.60	9.40	10.50	7.80	5.50	3.80	3.80	3.90	6.20	5.60
26	5.90	5.20	5.60	9.70	9.05	7.60	5.30	3.80	3.80	3.90	6.00	5.50
27	5.90	5.30	5.60	10.20	9.10	7.20	5.20	3.80	3.80	3.90	6.20	5.30
28	5.80	5.10	6.40	10.50	9.00	7.20	5.20	3.85	3.85	3.90	6.20	5.20
29	5.60	5.00	5.40	11.00	9.40	7.30	5.00	3.85	3.85	3.90	6.30	5.20
30	5.60	.....	5.60	10.90	9.40	7.60	5.00	3.80	3.80	3.80	6.30	5.10
31	5.50	.....	5.70	.....	9.50	.....	5.00	3.80	.....	3.80	.....	5.10

Rating table for Yakima River near Yakima, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.70	840	5.10	2,315	6.40	4,775	8.40	11,600
3.80	920	5.20	2,455	6.50	5,035	8.60	12,480
3.90	1,000	5.30	2,600	6.60	5,295	8.80	13,360
4.00	1,090	5.40	2,750	6.70	5,565	9.00	14,240
4.10	1,180	5.50	2,910	6.80	5,835	9.20	15,120
4.20	1,280	5.60	3,070	6.90	6,115	9.40	16,000
4.30	1,380	5.70	3,240	7.00	6,405	9.60	16,880
4.40	1,480	5.80	3,420	7.20	7,025	9.80	17,760
4.50	1,580	5.90	3,615	7.40	7,720	10.00	18,640
4.60	1,690	6.00	3,830	7.60	8,440	10.50	20,840
4.70	1,800	6.10	4,055	7.80	9,170	11.00	23,040
4.80	1,920	6.20	4,285	8.00	9,930	11.50	25,240
4.90	2,045	6.30	4,525	8.20	10,740	12.00	27,440
5.00	2,180						

The above table is applicable only for open-channel conditions. It is based upon 10 discharge measurements made during 1904. It is fairly well defined between gage heights 3.80 and 10.00. The table has been extended beyond these limits. Above gage height 8.30 feet the rating curve is a tangent, the difference being 440 per tenth.

Estimated monthly discharge of Yakima River near Yakima, Wash., for 1904.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	5,570	2,180	3,482	214,800	1.06	1.22
February	2,910	2,050	2,430	139,800	.736	.794
March	7,360	1,920	3,487	214,400	1.06	1.22
April	29,320	3,240	16,730	995,300	5.07	5.66
May	21,280	9,170	14,400	885,500	4.36	5.03
June	16,440	7,030	11,460	681,100	3.47	3.87
July	8,440	2,180	4,939	303,700	1.50	1.73
August	2,050	920	1,287	79,130	.390	.450
September	960	800	868	51,650	.263	.293
October	1,180	920	1,036	63,700	.314	.362
November	4,525	920	2,082	123,900	.631	.704
December	3,830	2,045	2,778	170,800	.842	.971
The year	29,320	800	5,415	3,924,000	1.64	22.30

YAKIMA RIVER AT PROSSER, WASH.

This station was established May 30, 1904, by G. H. Bliss. It is located at the highway bridge 600 feet below Prosser Falls at Prosser, Wash. A standard chain gage is attached to the upstream side of the bridge near the right bank. The length of the chain from the end of the weight to the marker is 28.06 feet. This length is marked on the upstream guard rail by means of two nails. The gage is read twice each day by J. N. Jacoby and Bernard Winter. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The bridge has a single span with trestle approach at either end. The initial point for soundings is a nail driven into the downstream guard rail 30 feet from the right bank. The channel is straight for about 100 feet above and 600 feet below the station. The current above the station is swift, the foot of the rapids being 150 feet above. The current below the station is sluggish at ordinary and swift at higher stages. Both banks are high and not subject to overflow. The bed of the stream is composed of rock, free from vegetation, and permanent. There are large bowlders in the channel. There is but one channel at all stages, broken by the trestle bents on either side during the higher stages. Bench mark No. 1 is a spike in a sill on the east end of the pump house of the Prosser Irrigation Company's canal. Its elevation is 13.870 feet above the datum of the gage. Bench mark No. 2 is a spike on upright bridge timber 20 feet south of the steel and concrete pier on the south bank. Its elevation is 11.422 feet above the datum of the gage. Bench mark No. 3 is the top of the steel cylinder of the concrete pier at the right bank, upstream side. Its elevation is 23.923 feet above the datum of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River at Prosser, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 30	G. F. Harley	228	2,500	5.90	10.08	[a] 14,800
July 26	do	151	1,340	1.51	4.00	2,030
August 11	do	136	1,020	.70	2.30	705
September 17	G. H. Bliss				.90	[b] 258

[a] Surface measurement.

[b] Flume, 175; river, 90; pump 7.

Mean daily gage height, in feet, of Yakima River at Prosser, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	10.04	7.50	3.46	1.08	1.58	17	8.75	5.58	1.87	.83	.....
2	.....	7.87	3.42	1.12	1.50	18	9.00	5.37	1.75	.83	.....
3	.....	8.08	3.33	1.17	1.75	19	9.37	4.75	1.67	.92	.....
4	9.62	8.29	3.25	1.04	1.75	20	9.33	4.71	1.50	.96	.....
5	9.75	8.37	3.12	1.12	1.75	21	9.04	4.54	1.42	.96	.....
6	10.00	8.31	2.92	1.17	1.75	22	8.71	4.50	1.33	.96	.....
7	10.21	8.08	2.75	1.12	1.75	23	8.54	4.37	1.29	1.00	.....
8	10.10	8.00	2.67	1.00	1.83	24	8.12	4.21	1.29	1.04	.....
9	9.50	7.50	2.54	.87	1.83	25	7.67	4.08	1.25	1.17	.....
10	9.04	7.25	2.42	.79	1.83	26	7.33	4.04	1.29	1.23	.....
11	8.79	7.08	2.33	.75	.....	27	7.17	3.87	1.21	1.42	.....
12	8.50	6.92	2.25	.83	.....	28	7.21	3.79	1.21	1.42	.....
13	8.23	6.67	2.12	.83	.....	29	7.37	3.75	1.17	1.42	.....
14	8.04	6.33	2.08	.83	.....	30	7.50	3.67	1.17	1.50	.....
15	8.19	6.08	2.00	.83	.....	31	.....	3.62	1.08	.....	.....
16	8.50	5.83	1.96	.92	.....						

Rating table for Yakima River at Prosser, Wash., from May 29 to October 10, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.80	252	2.40	766	3.90	1,920	5.80	4,800
.90	260	2.50	820	4.00	2,030	6.00	5,200
1.00	270	2.60	877	4.10	2,140	6.20	5,600
1.10	283	2.70	936	4.20	2,250	6.40	6,020
1.20	300	2.80	998	4.30	2,360	6.60	6,460
1.30	321	2.90	1,063	4.40	2,470	6.80	6,940
1.40	346	3.00	1,132	4.50	2,595	7.00	7,420
1.50	375	3.10	1,204	4.60	2,725	7.50	8,620
1.60	408	3.20	1,279	4.70	2,860	8.00	9,820
1.70	445	3.30	1,358	4.80	3,000	8.50	11,020
1.80	485	3.40	1,439	4.90	3,150	9.00	12,220
1.90	527	3.50	1,523	5.00	3,310	9.50	13,420
2.00	570	3.60	1,610	5.20	3,660	10.00	14,620
2.10	616	3.70	1,705	5.40	4,020	10.50	15,820
2.20	664	3.80	1,810	5.60	4,400	11.00	17,020
2.30	714						

The above table is applicable only for open-channel conditions. It is well defined to gage height 10.08 feet. The table has been extended above this limit. Above gage height 6.60 feet the rating curve is a tangent, the difference being 240 per tenth.

Estimated monthly discharge of Yakima River at Prosser, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April[a]			16,670	957,000
May[a]			13,810	849,400
June[b]	15,100	7,780	11,500	695,000
July	10,660	1,610	5,512	338,900
August	1,480	280	658	40,460
September	375	250	282	16,780
October 1–10			457	9,243
The period				2,907,000

[a] Estimated from discharge at Union Gap. [b] Discharge estimated for June 2 and 3.

NOTE.—The discharges given above are those which occur below the wasteway of flume of Prosser Falls power house. Flume waste = 200 second-feet

YAKIMA RIVER AT KIONA, WASH.

This station was established August 20, 1895. It is located at the highway bridge on the county road about 1,800 feet northwest of the Northern Pacific Railroad station at Kiona, Wash. It is about 23 miles above the mouth of the river. The original gage consisted of an inclined and a vertical section, spiked to the east end of the south pier of the bridge and anchored with rocks. The present gage is of the wire type, and is located on the downstream side of the bridge between the fifth and seventh verticals from the right bank. The length of the wire from the end of the weight to the marker is 27.21 feet. The distance from the end of the scale board to the outside edge of the pulley is 2.00 feet. The gage is read once each day by W. A. Kelso. Discharge measurements are made from the upstream side of the bridge to which the gage is attached. There is a stay wire 70 feet above the bridge. The initial point for soundings is a point on the west side of the bridge 100 feet south of the center of the south pier of the main span. The channel is straight for 500 feet above and for 400 feet below the station. The current has a moderate velocity. The right bank is low, but is well protected by a levee and is not subject to overflow. The left bank is somewhat higher and is not subject to overflow. The bed of the stream is composed of fine gravel, not subject to change. At low water the river flows beneath the middle main span; at high water it passes under an additional shorter span at each end of the bridge. Bench mark No. 1 is the top of a spike in the east end of the cap of the first trestlebent on the right bank. Its elevation above gage datum is 20.94 feet. Bench mark No. 2 is a spike on the north side of the stay-wire post on the right bank. Its elevation above gage datum is 18.73 feet. Bench mark No. 3 is a nail in

the upstream end of the first trestle bent on the left bank. Its elevation is 18.73 feet above gage datum. The top of the 2-inch pulley is 25.62 feet above gage datum. The United States Geological Survey standard iron bench-mark post, near the Northern Pacific Railroad station, has an elevation above sea level of 515 feet. The elevation of gage datum above sea level is 453 feet. All bench marks are marked "B. M." with black paint.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Yakima River at Kiona, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 6	G. F. Harley	326	2,600	5.34	10.59	13,880
September 8	do	205	528	.41	2.70	217

Mean daily gage height, in feet, of Yakima River at Kiona, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.45	5.55	5.20	6.05	13.05	10.65	8.20	4.40	2.70	3.10	3.60	6.65
2	5.40	5.50	5.15	6.25	12.10	10.20	8.35	4.30	2.70	3.20	3.60	6.40
3	5.40	5.50	5.15	6.90	11.45	10.30	8.45	4.20	2.75	3.20	3.65	6.65
4	5.35	5.50	5.10	7.10	10.80	10.25	8.70	4.10	2.75	3.25	3.85	6.50
5	5.35	5.45	5.00	7.95	10.60	10.40	8.90	4.00	2.75	3.25	4.00	5.90
6	5.30	5.40	5.05	8.10	10.25	10.65	8.80	3.90	2.75	3.30	4.00	5.80
7	5.25	5.40	5.70	9.05	9.85	10.90	8.55	3.85	2.75	3.30	4.05	5.70
8	5.20	5.35	7.40	8.65	9.50	10.65	8.40	3.80	2.65	3.30	4.05	5.60
9	5.20	5.30	7.55	8.50	9.30	10.00	8.15	3.80	2.70	3.30	4.15	5.45
10	5.35	5.25	7.50	8.80	9.20	9.60	7.75	3.80	2.70	3.30	4.10	5.40
11	5.35	5.25	7.50	9.20	9.15	9.30	7.45	3.60	2.70	3.35	4.15	5.30
12	5.35	5.25	7.50	10.90	9.10	9.05	7.20	3.60	2.70	3.35	4.10	5.35
13	5.30	5.25	7.10	11.80	9.20	8.75	7.05	3.50	2.65	3.90	4.15	5.25
14	5.90	5.15	6.85	12.55	9.30	8.70	6.70	3.45	2.65	3.95	4.10	5.20
15	6.55	5.20	6.80	13.50	9.50	8.75	6.50	3.40	2.65	3.95	4.20	5.15
16	6.90	5.20	6.65	14.60	9.85	9.15	6.20	3.35	2.70	3.90	4.20	5.40
17	7.00	5.15	6.45	15.00	10.25	9.40	5.95	3.30	2.70	3.80	4.15	5.80
18	7.05	5.10	6.45	14.40	10.25	9.55	5.75	3.30	2.70	3.80	4.20	5.90
19	6.80	5.00	6.35	13.65	10.30	9.90	5.60	3.20	2.75	3.75	4.20	7.00
20	6.60	5.10	6.35	13.45	10.35	9.75	5.45	3.00	2.75	3.75	4.20	7.00
21	6.20	5.05	6.35	13.55	10.40	9.50	5.25	3.00	2.75	3.75	4.30	6.15
22	6.20	5.05	6.30	13.55	10.70	9.25	5.20	3.00	2.70	3.75	6.20	6.20
23	6.20	5.05	6.20	13.25	11.45	9.05	5.15	2.95	2.70	3.80	6.80	6.30
24	6.20	5.20	6.10	12.75	11.90	8.60	5.05	2.90	2.75	3.80	6.70	6.20
25	5.90	5.35	6.00	11.85	12.35	8.15	5.00	2.90	2.75	3.75	6.60	6.00
26	5.95	5.25	5.90	11.60	11.75	7.80	4.90	2.90	2.75	3.75	6.30	5.80
27	5.85	5.25	5.85	11.35	11.00	7.75	4.80	2.80	2.80	3.70	6.50	5.65
28	5.80	5.25	5.75	11.80	10.75	7.70	4.75	2.75	3.00	3.65	6.30	5.60
29	5.70	5.25	5.70	12.50	10.70	7.90	4.65	2.65	3.00	3.60	6.45	5.50
30	5.60	.....	5.80	13.05	10.80	8.00	4.55	2.65	3.10	3.65	6.15	5.50
31	5.65	.....	5.80	.....	10.75	.....	4.50	2.70	.....	3.70	.....	5.80

Rating table for Yakima River at Kiona, Wash., from January 1, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.60	195	4.30	1,160	6.00	3,320	8.40	8,350
2.70	215	4.40	1,250	6.10	3,480	8.60	8,830
2.80	245	4.50	1,350	6.20	3,650	8.80	9,320
2.90	280	4.60	1,450	6.30	3,820	9.00	9,820
3.00	315	4.70	1,560	6.40	3,990	9.20	10,320
3.10	355	4.80	1,670	6.50	4,170	9.40	10,840
3.20	395	4.90	1,780	6.60	4,350	9.60	11,360
3.30	440	5.00	1,900	6.70	4,540	9.80	11,880
3.40	490	5.10	2,020	6.80	4,740	10.00	12,400
3.50	555	5.20	2,150	6.90	4,950	10.50	13,720
3.60	620	5.30	2,280	7.00	5,160	11.00	15,100
3.70	690	5.40	2,420	7.20	5,600	11.50	16,580
3.80	760	5.50	2,560	7.40	6,040	12.00	18,080
3.90	835	5.60	2,700	7.60	6,480	13.00	21,080
4.00	910	5.70	2,850	7.80	6,940	14.00	24,080
4.10	990	5.80	3,000	8.00	7,400	15.00	27,080
4.20	1,070	5.90	3,160	8.20	7,870		

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1903 and 1904. It is well defined to gage height, 9.00 feet. The table has been extended beyond this limit.

Estimated monthly discharge of Yakima River at Kiona, Wash., for 1904.

[Drainage area, 5,230 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	5,270	2,150	3,144	193,300	0.601	0.693
February	2,630	1,900	2,234	128,500	.427	.461
March	6,370	1,900	3,800	233,700	.727	.838
April	27,080	3,400	15,800	940,200	3.02	3.37
May	21,230	10,070	13,860	852,200	2.65	3.06
June	14,820	6,710	10,690	636,100	2.04	2.28
July	9,570	1,350	4,654	286,200	.890	1.03
August	1,250	205	551	33,880	.105	.121
September	355	205	232	13,800	.044	.049
October	872	355	620	38,120	.119	.137
November	4,740	620	1,892	112,600	.362	.404
December	5,160	2,085	3,166	194,700	.605	.698
The year	27,080	205	5,054	3,663,000	.966	13.14

KACHESS RIVER NEAR EASTON, WASH.

This station was established October 14, 1903, by G. H. Bliss. It is located 2 miles northwest of Easton, Wash., and one-half mile below the foot of Lake Kachess, at which a dam is being constructed by the Cascade Canal Company. The gage is an inclined rod on the left bank, directly under the cable. The gage is read once each day by W. W. Johnson. Discharge measurements are made by means of a cable car, tagged wire, and stay wire. The cable is of one-half inch plow steel and has a span of 120 feet. The initial point for soundings is the south side of the aspen tree to which the cable is fastened, on the left bank. The channel is straight for 600 feet above and for 150 feet below the station. The current is swift. Both banks are high, wooded, and not liable to overflow. The bed of the stream is composed of gravel and rocks, free from vegetation. The bench mark is the top of a large wire nail driven into the south side of the large aspen tree to which the cable is fastened, on the left or north bank. The tree is blazed and is marked "B. M." with black paint. The nail is near the base of the tree and has an elevation of 11.27 feet above the zero of the gage.

During periods noted in the table of gage heights the wasteway of the dam was closed and the entire flow of the river impounded. The tabulated mean monthly discharge for the months affected is the average for the entire month, including the period during which the wasteway was closed. No water is diverted above the gaging station.

Observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Kachess River near Easton, Wash., in 1903 and 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1903.		*Feet.*	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
October 14	G. H. Bliss	72	206	3.11	5.30	642
1904.						
May 12	G. F. Harley	74	193	2.73	5.06	527
May 18 [a]	G. H. Bliss		5	2.0	2.65	10
June 14	G. F. Harley	73	235	3.42	5.64	805
July 12	do		140	2.32	4.27	326
July 20	do		119	2.00	3.97	239
August 3	do	68	95	1.56	3.61	148
August 24	do	63	71	.90	3.26	64

[a] Floats, below station.

Mean daily gage height, in feet, of Kachess River near Easton, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.90	4.00	(a)	3.70	5.90	6.00	4.00	3.60	3.50	4.25	3.30	4.10
2	3.90	4.00	(a)	3.70	5.70	5.80	4.10	3.50	3.50	3.80	3.30	4.35
3	3.90	3.90	(a)	3.70	5.60	5.95	4.50	3.40	3.50	3.70	3.30	4.35
4	3.90	3.90	(a)	3.70	5.60	6.00	5.50	3.60	3.50	3.80	3.30	4.35
5	3.90	3.90	(a)	3.70	5.50	6.25	5.20	3.40	3.55	3.75	3.20	4.25
6	3.80	3.90	4.20	3.70	5.40	6.30	5.10	3.40	3.50	3.70	3.20	.....
7	3.80	3.90	4.60	3.70	5.40	6.20	5.00	3.40	3.50	3.65	3.20	.....
8	3.80	3.80	4.50	3.70	5.40	6.05	4.50	3.50	3.50	3.65	3.20	.....
9	3.80	3.80	4.50	3.70	5.30	6.00	4.40	3.60	3.50	3.60	3.20	.....
10	4.00	3.80	4.50	3.80	5.20	5.90	4.40	3.55	3.50	3.70	3.20	.....
11	4.00	3.80	4.50	3.80	5.20	5.80	4.40	3.50	3.50	3.60	3.20	.....
12	4.10	3.80	4.40	4.00	5.10	5.60	4.30	3.50	3.45	3.60	3.20	.....
13	4.20	3.80	4.40	4.00	5.15	5.60	4.20	3.50	3.25	3.60	3.20	.....
14	4.30	3.80	4.30	(a)	5.25	5.70	4.10	3.50	3.40	3.60	3.20	.....
15	4.40	3.80	4.20	(a)	5.30	5.60	4.10	3.50	3.50	3.60	3.20	.....
16	4.50	3.80	4.10	(a)	5.30	5.60	4.10	3.40	3.70	3.60	3.20	4.40
17	4.50	3.80	4.10	5.70	4.50	5.60	4.10	3.40	3.70	3.60	3.30	4.50
18	4.50	3.80	4.10	6.20	(a)	5.70	4.00	3.30	3.40	3.60	3.35	4.55
19	4.50	3.80	4.00	6.10	(a)	5.70	4.00	3.30	3.70	3.50	3.40	4.60
20	4.50	3.50	4.00	6.00	(a)	5.60	4.00	3.30	3.00	3.60	3.75	4.65
21	4.50	3.50	4.00	6.00	(a)	5.60	4.00	3.30	3.85	3.50	3.90	4.65
22	4.40	3.50	3.90	5.90	4.30	5.50	3.90	3.25	3.90	3.50	4.00	4.65
23	4.30	3.60	3.90	5.90	4.80	5.40	3.90	3.50	3.85	3.30	4.10	4.65
24	4.30	(a)	3.80	5.80	5.10	5.30	3.80	3.55	3.80	3.40	4.10	4.60
25	4.20	(a)	3.80	5.60	5.10	5.20	3.80	3.55	3.80	3.40	4.10	4.55
26	4.20	(a)	3.80	5.50	5.20	5.15	3.80	3.55	3.80	3.40	4.10	4.50
27	4.10	(a)	3.70	5.60	5.30	4.90	3.80	3.55	3.90	3.40	4.10	4.40
28	4.10	(a)	3.70	5.70	5.40	4.40	3.75	3.55	3.90	3.30	4.25	4.40
29	4.00	(a)	3.70	5.90	5.50	4.15	3.80	3.55	3.80	3.29	4.35	4.40
30	4.00	.....	3.70	5.90	5.90	3.90	3.60	3.55	3.80	3.30	4.35	4.35
31	4.00	.....	3.70	.....	6.00	.....	3.60	3.55	.....	3.30	.....	4.30

[a] Water shut off at dam.

Rating table for Kachess River near Easton, Wash., from November 20, 1903, to December 31 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.60	9	3.60	145	4.60	420	5.60	785
2.70	12	3.70	170	4.70	450	5.70	825
2.80	17	3.80	195	4.80	485	5.80	865
2.90	24	3.90	220	4.90	520	5.90	910
3.00	33	4.00	245	5.00	555	6.00	955
3.10	44	4.10	270	5.10	590	6.10	1,000
3.20	57	4.20	300	5.20	625	6.20	1,050
3.30	73	4.30	330	5.30	665	6.30	1,100
3.40	95	4.40	360	5.40	705	6.40	1,150
3.50	120	4.50	390	5.50	745	6.50	1,200

The preceding table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is well defined between gage heights 2.60 feet and 5.60 feet. The table has been extended beyond these limits. Above gage height 6.10 feet the rating curve is a tangent, the difference being 50 per tenth.

Estimated monthly discharge of Kachess River near Easton, Wash., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
November 20–30	530	170	353	7,702	5.60	2.29
December	745	245	426	26,190	6.76	7.79
1904.						
January	390	195	286	17,580	4.54	5.23
February	245	[b] 0	153	8,801	2.43	2.62
March	420	[b] 0	227	13,960	3.60	4.15
April	1,050	[b] 0	495	29,460	7.86	8.77
May	955	[b] 0	588	36,160	9.33	10.76
June	1,100	220	778	46,290	12.30	13.72
July	745	145	305	18,750	4.84	5.58
August	145	65	113	6,948	1.79	2.06
September	220	33	147	8,747	2.33	2.60
October	315	73	138	8,485	2.19	2.52
November	345	57	141	8,390	2.24	2.50
December [a]			376	23,120	5.97	6.88
The year			312	226,700	4.95	67.39

[a] Discharge December 6 to 15 interpolated. [b] Water shut off at dam.

CLEALUM RIVER NEAR ROSLYN, WASH.

This station was established October 10, 1903, by G. H. Bliss. It is located 1,000 feet below the outlet of Lake Clealum. It is 2½ miles northwest of Roslyn and 6½ miles northwest of Clealum, Wash. The gage is an inclined rod on the left bank, 20 feet upstream from the cable. It is read once each day by Charles M. Davis. Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the south face of the black pine tree, 18 inches in diameter, to which the cable is fastened, on the left bank. The channel is straight for 300 feet above and for 900 feet below the station. The current is swift. Both banks are high, not liable to overflow, and are heavily timbered. The bed of the stream is composed of gravel, free from vegetation, and permanent. The bench mark is a large spike driven into the root of the

tree to which the cable is fastened, on the left bank. The root is on the east or downstream side of the tree, and the tree is blazed. The elevation of the bench mark is 17.40 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Clealum River near Roslyn, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 11	G. F. Harley	130	906	1.46	4.05	1,319
May 18	Bliss and Murphy	141	1,146	2.46	5.60	2,820
May 23	G. F. Harley	154	1,383	3.22	7.15	4,459
June 13	do	135	1,036	1.98	4.85	2,048
June 22	do	140	1,124	2.29	5.50	2,580
July 20	do	127	809	1.11	3.22	897
August 4	do	123	763	0.91	2.81	693
August 18	do	120	696	0.69	2.27	480
August 31	do	118	649	0.58	1.86	378
September 22	do	117	608	0.36	1.49	220
September 26[a]	do	148	187	1.17	1.38	219

[a] Wading 800 feet above station.

Mean daily gage height, in feet, of Clealum River near Roslyn, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
1	2.10	2.50	1.70	1.65	5.45	6.00	5.70	2.85	1.80	1.55	1.30	2.80
2	2.05	2.35	1.70	1.70	5.30	5.90	5.80	2.85	1.75	1.60	1.35	2.75
3	2.00	2.10	1.68	1.70	5.10	5.95	5.70	2.80	1.70	1.55	1.35	2.65
4	2.01	2.08	1.65	1.90	4.90	6.50	5.60	2.80	1.70	1.50	1.35	2.60
5	2.00	2.03	1.65	2.00	4.70	6.70	5.45	2.80	1.70	1.50	1.45	2.50
6	2.00	2.00	1.70	2.10	4.55	6.90	5.45	2.75	1.70	1.50	1.45	2.40
7	1.95	2.00	1.70	2.20	4.35	6.50	5.40	2.75	1.70	1.45	1.45	2.20
8	1.97	1.50	1.73	2.20	4.30	6.10	5.20	2.75	1.70	1.40	1.45	2.10
9	2.00	1.96	1.75	2.35	4.10	5.60	5.00	2.70	1.70	1.40	1.50	2.00
10	2.20	1.85	1.75	3.35	3.90	5.40	4.85	2.70	1.70	1.35	1.55	2.00
11	2.20	1.90	2.00	3.60	4.00	5.20	4.70	2.65	1.65	1.45	1.55	1.95
12	2.35	1.95	2.20	4.80	4.20	4.90	4.55	2.50	1.60	1.50	1.55	1.90
13	2.50	2.00	2.30	5.70	4.50	4.95	4.35	2.45	1.55	1.55	1.55	1.90
14	2.90	1.90	2.20	6.10	4.65	5.00	4.10	2.40	1.50	1.60	1.45	2.00
15	3.20	1.90	2.10	6.60	5.25	5.40	3.85	2.35	1.45	1.65	1.45	2.30
16	3.27	1.90	2.05	6.70	5.40	5.75	3.60	2.30	1.40	1.65	1.50	2.50
17	3.20	1.85	2.10	6.35	5.45	5.80	3.45	2.30	1.40	1.65	1.60	2.60
18	3.20	1.80	2.20	5.90	5.60	6.00	3.40	2.25	1.40	1.60	1.80	2.70
19	3.00	1.80	2.20	5.60	5.80	6.20	3.30	2.25	1.40	1.55	1.90	2.80
20	2.90	1.80	2.35	5.50	6.30	5.90	3.20	2.20	1.40	1.50	2.10	2.75
21	2.85	1.82	2.35	5.50	6.45	5.70	3.15	2.15	1.40	1.50	2.60	2.70
22	2.77	1.80	2.30	5.50	6.80	5.50	3.20	2.10	1.40	1.50	2.70	2.65
23	2.70	1.85	2.20	5.45	7.05	5.15	3.25	2.10	1.40	1.50	2.90	2.60

Mean daily gage height, in feet, of Clealum River near Roslyn, Wash., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
24	2.60	1.90	1.90	5.45	7.20	4.80	3.25	2.05	1.40	1.50	2.85	2.60
25	2.50	1.90	1.90	5.00	6.80	4.50	3.20	1.95	1.35	1.45	2.75	2.50
26	2.40	1.85	1.65	4.90	6.50	4.50	3.15	1.90	1.30	1.40	2.60	2.40
27	2.40	1.80	1.65	4.70	6.10	4.60	3.15	1.80	1.30	1.30	2.60	2.30
28	2.30	1.83	1.70	5.60	6.10	4.90	3.15	1.80	1.35	1.20	2.80	2.20
29	2.27	1.75	1.60	6.50	6.20	5.10	3.10	1.80	1.40	1.20	2.90	2.10
30	2.20	.....	1.63	6.55	6.25	5.40	3.00	1.80	1.50	1.20	2.85	2.15
31	2.70	.....	1.60	.....	6.15	.....	2.90	1.80	.....	1.25	.....	2.20

Rating table for Clealum River near Roslyn, Wash., from October 10, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	165	2.80	685	4.30	1,520	5.80	2,890
1.30	190	2.90	725	4.40	1,590	5.90	2,990
1.40	215	3.00	770	4.50	1,670	6.00	3,100
1.50	240	3.10	815	4.60	1,750	6.10	3,210
1.60	270	3.20	865	4.70	1,830	6.20	3,320
1.70	300	3.30	915	4.80	1,920	6.30	3,430
1.80	330	3.40	965	4.90	2,010	6.40	3,540
1.90	360	3.50	1,020	5.00	2,100	6.50	3,660
2.00	390	3.60	1,075	5.10	2,190	6.60	3,780
2.10	425	3.70	1,130	5.20	2,290	6.70	3,900
2.20	460	3.80	1,185	5.30	2,390	6.80	4,020
2.30	495	3.90	1,245	5.40	2,490	6.90	4,140
2.40	530	4.00	1,310	5.50	2,590	7.00	4,260
2.50	565	4.10	1,380	5.60	2,690	7.10	4,390
2.60	605	4.20	1,450	5.70	2,790	7.20	4,520
2.70	645						

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.20 feet and 7.20 feet.

Estimated monthly discharge of Clealum River near Roslyn, Wash., for 1903 and 1904.

[Drainage area, 205 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
October 10-31	1,534	589	967	42,200	4.72	3.86
November	1,630	478	746	44,390	3.64	4.06
December	3,900	425	1,022	62,840	4.98	5.74
1904.						
January	900	375	567	34,860	2.77	3.19
February	565	240	367	21,110	1.79	1.93
March	512	270	367	22,570	1.79	2.06
April	3,900	285	1,971	117,300	9.61	10.72
May	4,520	1,245	2,629	161,700	12.82	14.78
June	4,140	1,670	2,676	159,200	13.05	14.56
July	2,890	725	1,512	92,970	7.38	8.51
August	705	330	517	31,790	2.52	2.90
September	330	190	250	14,880	1.22	1.36
October	285	165	234	14,390	1.14	1.31
November	725	190	391	23,270	1.91	2.13
December	685	360	527	32,400	2.57	2.96
The year	4,520	165	1,001	726,400	4.88	66.41

NACHES RIVER NEAR NILE, WASH.

This station was established June 25, 1904, by G. F. Harley. It is located 1¾ miles above the highway bridge, 23 miles northwest of North Yakima, and 8 miles southeast of Nile, Wash. The station is 1¾ miles above the junction of Naches and Tieton rivers. An inclined staff gage, graduated to read direct to feet and tenths, is fastened to timbers buried on the left bank. The gage is read once each day by W. F. White. Discharge measurements are made by means of a cable, car, and tagged wire, at the gage. The cable has a span of 216 feet. The initial point for soundings is the south face of the pine to which the cable is fastened on the north bank. The channel is straight for about 600 feet above and 300 feet below the station. The current is moderate at the station, and swift above and below. The right bank is low, wooded, and overflows only during extreme high floods. The left bank is high, rocky, clean, and not liable to overflow. The bed of the stream is composed of clean gravel and cobbles, and is permanent. There is one channel at all except very

high stages, when there are two. The section is flat and shallow. Bench mark No. 1 is a point on the ledge 25 feet upstream from the tree supporting the cable on the north bank, marked with a cross and "B. M." Its elevation is 9.85 feet above the zero of the gage. Bench mark No. 2 is a large spike in the base of a 30-inch pine tree 115 feet upstream from the north cable support. Its elevation is 8.76 feet above the zero of the gage. Bench mark No. 3 is a United States Geological Survey standard bronze tablet set in a bowlder 700 feet east of north cable support, 300 feet from the river, marked on the tablet "1661." Its exact elevation is 1,660.824 feet above sea level and 9.20 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Naches River near Nile, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 25	G. F. Harley	192	490	4.39	5.25	2,150
July 6	do	192	540	5.00	5.55	2,720
July 16	do	190	370	3.43	4.63	1,270
July 28	do	190	290	2.78	4.25	805
August 12	do	189	215	2.16	3.84	465
September 6	J. C. Dry	186	182	1.70	3.61	310

Mean daily gage height, in feet, of Naches River near Nile, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.80	4.10	3.50	3.20	3.30	4.40
2		5.80	4.10	3.50	3.30	3.30	4.30
3		5.70	4.10	3.50	3.30	3.30	4.20
4		5.70	4.10	3.40	3.30	3.30	4.10
5		5.70	4.00	3.40	3.30	3.30	4.00
6		5.60	4.00	3.40	3.30	3.30	4.00
7		5.50	4.00	3.20	3.30	3.35	3.90
8		5.40	4.00	3.10	3.30	3.40	3.90
9		5.30	4.00	3.10	3.30	3.40	3.80
10		5.20	3.70	3.20	3.30	3.40	3.80
11		5.10	3.70	3.10	3.50	3.40	3.80
12		5.10	3.70	3.05	3.70	3.40	3.80
13		5.00	3.70	3.05	3.50	3.35	3.80
14		4.80	3.60	3.05	3.60	3.30	4.10
15		4.70	3.60	3.05	3.55	3.35	4.00
16		4.60	3.60	3.05	3.40	3.40	4.00
17		4.60	3.60	3.05	3.45	3.45	4.00
18		4.50	3.50	3.00	3.50	3.50	4.00
19		4.50	3.50	3.00	3.45	3.50	4.00
20		4.40	3.50	3.00	3.40	4.00	4.00
21		4.40	3.50	3.00	3.45	5.05	4.10
22		4.50	3.50	3.10	3.45	5.40	4.00

Mean daily gage height, in feet, of Naches River near Nile, Wash., for 1904—Continued.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
23	.....	4.50	3.50	3.10	3.40	5.20	3.90
24	.....	4.40	3.50	3.10	3.30	4.80	3.80
25	5.30	4.40	3.50	3.10	3.30	4.60	3.80
26	5.30	4.30	3.50	3.05	3.30	4.80	3.90
27	5.40	4.30	3.50	3.05	3.30	4.70	3.80
28	5.50	4.30	3.50	3.05	3.30	5.00	3.80
29	5.60	4.20	3.50	3.05	3.30	4.80	3.90
30	5.70	4.20	3.50	3.05	3.30	4.70	4.00
31	.....	4.20	3.50	.....	3.30	.....	3.90

Rating table for Naches River near Nile, Wash., from June 25 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.00	139	3.90	496	4.80	1,476	5.70	2,997
3.10	158	4.00	576	4.90	1,614	5.80	3,185
3.20	181	4.10	664	5.00	1,760	5.90	3,373
3.30	208	4.20	760	5.10	1,914	6.00	3,561
3.40	239	4.30	864	5.20	2,078	6.10	3,749
3.50	274	4.40	975	5.30	2,250	6.20	3,937
3.60	316	4.50	1,093	5.40	2,433	6.30	4,125
3.70	366	4.60	1,216	5.50	2,621	6.40	4,313
3.80	425	4.70	1,344	5.60	2,809	6.50	4,501

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 3.61 feet and 5.55 feet. The table has been extended beyond these limits. Above gage height 5.50 feet the rating curve is a tangent, the difference being 188 per tenth.

Estimated monthly discharge of Naches River near Nile, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June 25–30	2,997	2,250	2,560	30,470
July	3,185	760	1,662	102,200
August	664	274	390	23,980
September	274	139	173	10,290
October	366	181	234	14,390
November	2,433	208	713	42,430
December	975	425	553	34,000
The period	.....	.....	.....	257,800

NACHES RIVER NEAR NORTH YAKIMA, WASH.

Naches River has its source in the Cascade Mountains, Yakima County, Wash., and flows southeasterly, entering Yakima River a short distance above North Yakima. Its principal tributaries are Tieton River, Cowiche, Rattlesnake, and Nile creeks, and Bumping River. The flow of the latter has already been increased by American River when it joins the Naches.

Naches River is important because of its rapid fall and the ease with which it can be used for irrigation purposes. Naches Valley, through which it flows, is already extensively irrigated from it. It is also the source of domestic water supply for the town of North Yakima and of water supply and power for the Northwestern Light and Water Company.

Two gaging stations are at present maintained upon Naches River, one near its junction with the Yakima and one just above the mouth of the Tieton.

The original station on Naches River was established August 14, 1893, by Mr. F. H. Newell, at a point a few hundred yards above the mouth of the river, near the bridge of the Northern Pacific Railroad.

The first gage, known as No. 1, was vertical and was nailed to the cribwork on the right-hand side of the river, above the railroad bridge. The 12-foot mark was 9.97 feet below the top of the rail on the bridge, the gage being about 60 feet easterly from the rail. The top of the iron pier, on the southeast end of the county bridge, was 5.87 feet above this 12-foot mark. Measurements were made from the county bridge. The locality was, however, not favorable for the purpose, as the water was very swift and was broken by the piers of the bridge. Owing to the difficulty of securing accurate measurements the readings were discontinued on September 20, 1894, and not resumed until August 19, 1895.

When the station was visited in July, 1896, it was found that the channel under the bridge, from which previous gagings had been made, had been greatly changed by the deposition of several carloads of rock and by the building of a short wing dam placed just above the gage rod. On July 28 gage No. 1 was removed and gage No. 2 fastened to the bulwark just above the highway bridge, and about 100 yards above its old position. The gage height in its old position when removed was 3.8, in its new position when placed 2.4. When the station was visited October 21 it was found that the water had fallen below the end of gage No. 2, and it was therefore removed and fastened again to the bulwark just below the highway bridge, and lowered in elevation 1 foot. Before changing, the gage height was −0.24 foot; after the change it was 0.76 foot. The gage-height records for 1896 are referred to this gage, known as gage No. 3.

The flood of November, 1896, modified the channel very greatly, depositing a large mass of coarse gravel and small bowlders along the right side of the channel at the section, so that the rod was about 50 feet from the edge of the water at low stages. The current is swift, even at low water. On account of the instability of the channel the station was abandoned in February, 1897, although a number of discharge measurements were made during the season.

May 19, 1897, a station was established on Yakima River 5 miles above the mouth of the Naches, at the Northern Pacific Railway bridge near Selah, Wash., with the idea that the difference in discharge between this station and the one at Union Gap would give approximately the discharge of Naches River. Two ditches, located in the Moxee Valley, took water out of the river between these two points, but their combined flow was about counterbalanced by that received from Atanum Creek and the Wide Hollow wastage at Old Town.

The station on Naches River was reestablished February 1, 1898, and the station at Selah, on Yakima River, was discontinued. Since the reestablishment of the Naches station the river channel has been in a condition more favorable for meter observations than formerly. Discharge measurements were made from the lower side of the highway bridge. A new horizontal gage rod, No. 4, with wire and weight, was attached to the main span of the Northern Pacific Railway bridge at the mouth of the Naches, a few hunderd feet downstream from the highway bridge. The length of the gage wire from index to foot of weight was 30.41 feet. The elevation of top of pulley was 24.57 feet. The bench mark was the top of the north end of east sill of clearance posts, about 150 feet north of Northern Pacific Railway bridge. Elevation, 23.77 feet above zero of gage. On December 27, 1898, the top of the northeast concrete pier of the highway bridge was found to be at an elevation of 22.09 feet above zero.

On June 20, 1899, the gage rod and bench mark having been disturbed during alterations to the railroad bridge and approaches, a new 4 by 4 inch inclined gage rod, No. 5, was established on the left bank of the river, 30 feet downstream from the railroad bridge. This is the gage in present use. The lower section of the rod is inclined at an angle of 36° 30′ with the horizontal. The upper section is inclined at an angle of 80° with the horizontal.

On September 21, 1903, the station was changed to a location between the railroad and highway bridge and equipped with a cable, car, tagged wire, and stay wire. The cable is located 180 feet above the Northern Pacific Railway bridge, and 170 feet below the highway bridge, at which discharge measurements were formerly made. The stay wire is 85 feet above the cable. The cable has a total span of 280 feet. The initial point for soundings is the south face of the

cottonwood tree to which the cable is fastened on the north bank. The channel is straight for 100 feet above and for 75 feet below the cable. The current is swift. Both banks are low and covered with gravel. At flood stages the rock-filled crib will prevent overflow on both banks. The bed of the stream is composed of gravel, free from vegetation, and somewhat shifting. Although the present location does not have many of the characteristics of an ideal gaging station it has more of them than any location below the Tieton.

Naches River below the Tieton, almost to the point where it enters the Yakima, flows over flat bars of river gravel in numerous, crooked, and constantly changing channels. These gravel bars are in some instances one-half mile in width.

The datum of gage board No. 5, now in use, has been referred to the following bench marks: Bench mark No. 1 is a United States Geological Survey copper plug marked "1090 T" and its elevation is 1,089.959 feet above sea level and 19.74 above the zero of the gage. It is located in the center of the west end of the most southerly stone pier of the railroad bridge. The elevation of the zero of the gage is 1,070.22 feet above sea level. Bench mark No. 2 is a cross in the top of the center of the downstream end of the railroad bridge pier on the right bank. Its elevation above the zero of the gage is 19.94 feet and above sea level is 1,090 feet. Bench mark No. 3 is a railroad spike driven into the south side of the telegraph pole 23 feet north of the gage and 21 feet east of the railroad track. Its elevation is 17.81 feet above the zero of the gage. The observer is Patrick Gallagher, section foreman for the Northern Pacific Railway, who lives in North Yakima.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Naches River near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 26	G. F. Harley	182	757	6.29	8.30	4,764
April 29	do	228	1,031	7.46	9.45	7,696
May 6	do	180	670	5.13	7.59	3,420
June 18	do	208	835	6.16	8.47	5,140
June 28	do	177	665	4.81	7.35	3,201
July 13	do	171	526	4.10	6.61	2,159
July 19	do	128	390	3.05	5.71	1,190
July 30	do	125	322	2.52	5.13	810
August 9	do	123	268	2.19	4.73	588
August 17	do	120	222	1.69	4.29	375
September 1	J. C. Dry	118	178	1.26	3.95	225
September 13	G. F. Harley	117	165	1.24	3.80	205

Mean daily gage height, in feet, of Naches River near North Yakima, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.10	5.90	5.70	6.10	8.80	8.30	7.80	5.10	4.00	4.00	4.00	6.00
2	6.10	5.90	5.60	6.20	8.40	8.20	7.80	5.00	3.90	3.95	3.90	5.80
3	6.10	5.90	5.60	6.50	8.20	8.20	7.80	5.00	3.80	3.90	3.90	5.60
4	6.10	5.90	5.60	6.80	8.20	8.30	7.80	4.90	3.75	3.90	3.90	5.45
5	6.10	5.80	5.60	6.80	7.90	8.50	7.90	4.90	3.70	3.90	3.90	5.30
6	6.00	5.80	5.70	7.50	7.70	8.70	7.70	4.80	3.70	3.80	4.00	5.20
7	6.00	5.80	5.80	7.30	7.40	8.60	7.60	4.80	3.60	3.80	4.10	5.10
8	6.00	5.80	6.20	7.30	7.40	8.20	7.50	4.80	3.60	3.80	4.20	5.00
9	6.00	5.80	6.20	7.40	7.40	7.80	7.20	4.70	3.60	3.85	4.20	5.00
10	6.00	5.80	6.60	8.20	7.40	7.80	7.10	4.60	3.60	3.90	4.10	5.00
11	6.00	5.80	6.50	8.90	7.40	7.60	7.00	4.50	3.65	4.00	4.10	4.95
12	6.00	5.80	6.40	9.50	7.60	7.40	6.90	4.50	3.70	4.70	4.10	4.90
13	6.00	5.80	6.35	10.00	7.80	7.30	6.60	4.40	3.70	4.40	4.10	4.90
14	6.70	5.75	6.30	10.30	8.20	7.50	6.20	4.40	3.70	4.40	4.20	4.90
15	6.90	5.70	6.30	10.30	8.30	7.90	6.10	4.40	3.70	4.40	4.20	5.10
16	6.80	5.70	6.20	9.70	8.40	8.10	6.00	4.40	3.60	4.30	4.30	5.20
17	6.70	5.70	6.20	9.40	8.30	8.20	5.95	4.40	3.60	4.20	4.30	5.20
18	6.60	5.70	6.20	9.00	8.40	8.50	5.90	4.30	3.60	4.10	4.30	5.20
19	6.50	5.70	6.20	9.30	8.50	8.30	5.80	4.30	3.60	4.10	4.30	5.20
20	6.50	5.70	6.15	9.50	8.60	8.10	5.70	4.20	3.60	4.10	5.45	5.20
21	6.40	5.70	6.10	9.50	8.90	8.00	5.70	4.15	3.60	4.00	6.60	5.20
22	6.40	5.70	6.10	9.10	9.30	7.90	5.70	4.10	3.70	4.00	6.70	5.10
23	6.40	5.80	6.00	8.70	9.70	7.60	5.70	4.10	3.70	4.00	6.60	5.10
24	6.25	5.80	6.00	8.50	9.50	7.20	5.65	4.10	3.80	4.00	6.20	5.10
25	6.10	5.80	6.00	8.20	9.00	7.00	5.60	3.90	3.80	4.00	6.10	5.00
26	6.00	5.80	6.00	8.30	8.60	7.00	5.60	3.90	3.80	4.00	6.10	4.90
27	6.00	5.80	5.95	8.90	8.50	7.10	5.60	3.80	3.80	4.00	6.25	4.90
28	6.00	5.75	5.90	9.30	8.50	7.30	5.40	3.90	3.90	4.00	6.40	4.90
29	6.00	5.70	5.90	9.70	8.55	7.50	5.20	4.00	3.90	4.00	6.30	4.90
30	6.00	.....	5.90	9.30	8.60	7.70	5.10	4.10	4.00	4.00	6.10	5.00
31	5.95	.....	6.00	.....	8.50	.....	5.10	4.00	.....	4.00	.....	5.20

NOTE.—Gage heights for Sundays interpolated.

Rating table for Naches River near North Yakima, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.60	163	5.00	725	6.40	1,882	7.80	3,856
3.70	182	5.10	781	6.50	2,004	7.90	4,025
3.80	205	5.20	839	6.60	2,128	8.00	4,199
3.90	232	5.30	898	6.70	2,255	8.20	4,585
4.00	263	5.40	961	6.80	2,384	8.40	5,040
4.10	298	5.50	1,028	6.90	2,515	8.60	5,539
4.20	335	5.60	1,099	7.00	2,648	8.80	6,051
4.30	374	5.70	1,174	7.10	2,785	9.00	6,563
4.40	415	5.80	1,253	7.20	2,926	9.20	7,075
4.50	458	5.90	1,339	7.30	3,071	9.40	7,587
4.60	507	6.00	1,433	7.40	3,220	9.60	8,099
4.70	559	6.10	1,535	7.50	3,373	9.80	8,611
4.80	613	6.20	1,645	7.60	3,530	10.00	9,123
4.90	669	6.30	1,762	7.70	3,691	10.20	9,635

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1904. It is well defined between gage heights 3.80 feet and 9.45 feet. The table has been extended beyond these limits. Above gage height 8.60 feet the rating curve is a tangent, the difference being 256 per tenth.

Estimated monthly discharge of Naches River near North Yakima, Wash., for 1904.

[Drainage area, 1,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	2,530	1,400	1,691	104,000	1.69	1.95
February	1,350	1,180	1,245	71,610	1.24	1.34
March	2,140	1,110	1,511	92,910	1.51	1.74
April	9,890	1,550	5,706	339,500	5.71	6.37
May	8,360	3,230	5,016	308,400	5.02	5.79
June	5,800	2,660	4,074	242,400	4.07	4.54
July	4,030	780	2,076	127,600	2.08	2.40
August	780	210	436	26,810	.436	5.03
September	260	160	189	11,200	.189	.211
October	560	200	284	17,460	.284	.327
November	2,260	230	832	49,510	.832	.928
December	1,440	670	816	50,170	.816	.941
The year	9,890	160	1,989	1,442,000	1.99	27.04

TIETON RIVER NEAR NORTH YAKIMA, WASH.

The gaging station on this stream was established April 14, 1902, at a point immediately below the mouth of Oak Creek, in sec. 3, T. 14 N., R. 16 E. of the Willamette meridian, and about 22 miles from North Yakima by road. The gage rod is inclined at an angle of 55° with the horizontal, and is on the left bank of the stream. It consists of a 1 by 5 inch cedar plank, supported and braced by stout logs. The equipment with which measurements are made consists of a ⅝-inch cable, car, tag wire, and stay wire. The initial point for soundings is a cross chiseled in a ledge, with a black ring painted around it. It is under the cable, 4 feet east of the west shear legs. The observer is Omer Tetherow, a farmer. There are no side channels and the banks are not subject to overflow. The bed of the stream is rocky, with shifting gravel bars, which make it difficult to find suitable cross sections for meter measurements. The point selected for the station is, however, a fairly good one, and the channel is straight both above and below the station for several hundred yards. At low water the underground flow at this station is estimated to be as much as 50 per cent of the measured flow. Bench mark No. 1 is a point of rock on a ledge 12 feet from the gage. Its elevation above gage datum is 15.67. Bench mark No. 2 is a nail in a cottonwood stump 40 feet south of the gage. Its elevation above gage datum is 15.93. Bench mark No. 3 is top of a bowlder 20 feet northwest of the cable shear legs. Its elevation above gage datum is 17.52. The gage datum is 1,683.365 above sea level.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Tieton River near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 28	G. F. Harley	118	365	7.00	10.65	2,569
May 18	do	116	288	5.38	9.65	1,550
June 26	do	114	251	4.26	8.90	1,065
July 7	do	116	280	5.21	9.55	1,460
July 15	do	109	208	3.77	8.35	785
July 28	do	108	185	3.41	8.12	630
August 12	do	107	157	2.83	7.65	445
September 7	J. C. Dry	106	136	2.85	7.40	397

Mean daily gage height, in feet, of Tieton River near North Yakima, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.15	7.10	6.95	7.20	9.65	9.70	9.75	8.00	7.25	7.25	6.70	7.70
2	7.20	7.10	6.95	7.40	9.50	9.70	9.55	8.05	7.25	7.20	6.70	7.55
3	7.20	7.00	6.95	7.70	9.40	9.85	9.60	7.95	7.30	7.10	6.70	7.35
4	7.15	7.15	6.95	7.80	9.35	9.90	9.80	7.90	7.30	7.00	6.65	7.25
5	7.10	7.05	6.95	7.90	9.25	10.00	9.75	7.95	7.30	7.00	6.70	7.25
6	7.10	7.10	7.00	8.20	9.05	10.15	9.55	8.00	7.35	6.95	6.65	7.20
7	7.10	7.10	7.35	8.05	9.00	9.70	9.50	8.05	7.35	6.95	6.75	7.15
8	7.10	7.05	7.60	8.20	8.95	9.45	9.25	7.95	7.35	6.90	6.85	7.15
9	7.15	6.85	7.65	8.40	8.85	9.35	9.10	7.85	7.45	6.90	6.75	7.10
10	7.15	7.00	7.60	8.90	8.90	9.35	9.00	7.75	7.35	6.85	6.70	7.10
11	7.10	7.10	7.60	9.60	9.05	9.10	9.15	7.70	7.25	7.80	6.65	7.05
12	7.25	7.00	7.45	10.15	9.15	8.95	9.00	7.60	7.20	7.45	6.70	7.00
13	7.70	7.00	7.40	10.50	9.30	9.05	8.70	7.60	7.20	7.15	6.65	7.05
14	7.80	7.00	7.40	11.10	9.60	9.30	8.50	7.70	7.10	7.00	6.60	7.10
15	7.80	7.00	7.35	10.95	9.55	9.65	8.35	7.75	7.10	6.95	6.75	7.75
16	7.75	7.00	7.15	10.50	9.50	9.80	8.30	7.70	7.10	6.90	6.85	7.35
17	7.65	6.95	7.30	10.10	9.55	9.90	8.20	7.60	7.20	6.85	7.00	7.45
18	7.60	6.95	7.25	10.10	9.70	10.35	8.10	7.60	7.10	6.85	6.90	7.45
19	7.50	6.95	7.25	10.25	9.80	9.65	8.00	7.60	7.05	6.85	6.80	7.45
20	7.35	7.00	7.25	10.55	9.90	9.50	8.15	7.60	7.05	6.80	8.05	7.55
21	7.45	7.00	7.25	10.40	10.30	9.60	8.25	7.45	7.00	6.85	9.15	7.45
22	7.40	7.20	7.20	10.10	10.80	9.50	8.55	7.40	7.15	6.85	8.75	7.40
23	7.40	7.15	7.20	9.70	10.90	9.20	8.45	7.40	7.15	6.80	8.30	7.30
24	7.35	7.05	7.10	9.45	10.65	8.90	8.05	7.35	7.05	6.75	8.00	7.30
25	7.20	6.95	7.05	9.40	10.10	8.80	8.20	7.30	7.05	6.75	8.00	7.15
26	7.25	7.00	7.05	9.65	9.90	8.85	8.20	7.35	7.05	6.75	8.30	7.00
27	7.15	7.00	7.10	10.65	9.85	9.10	8.25	7.45	7.05	6.75	8.20	7.00
28	7.10	7.00	7.10	10.80	10.00	9.30	8.15	7.50	7.10	6.75	8.25	7.10
29	7.20	6.95	7.10	10.05	10.05	9.40	7.95	7.55	7.30	6.70	8.00	7.20
30	7.20	.....	7.15	9.55	10.05	9.65	7.90	7.40	7.25	6.70	7.80	7.90
31	7.10	.....	7.15	.....	9.85	.....	7.95	7.35	.....	6.70	.....	7.55

Rating table for Tieton River near North Yakima, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
6.50	210	7.80	500	9.10	1,180	10.40	2,250
6.60	220	7.90	540	9.20	1,240	10.50	2,370
6.70	233	8.00	580	9.30	1,300	10.60	2,490
6.80	249	8.10	625	9.40	1,370	10.70	2,620
6.90	267	8.20	670	9.50	1,440	10.80	2,750
7.00	287	8.30	720	9.60	1,510	10.90	2,880
7.10	308	8.40	775	9.70	1,590	11.00	3,010
7.20	330	8.50	830	9.80	1,670	11.20	3,270
7.30	353	8.60	885	9.90	1,750	11.40	3,530
7.40	376	8.70	940	10.00	1,840	11.60	3,790
7.50	400	8.80	1,000	10.10	1,930	11.80	4,050
7.60	430	8.90	1,060	10.20	2,030	12.00	4,310
7.70	465	9.00	1,120	10.30	2,140		

The preceding table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is well defined between gage heights 7.00 feet and 9.70 feet. The table has been extended beyond these limits. Above gage height 10.60 feet the rating curve is a tangent, the difference being 130 per tenth.

Estimated monthly discharge of Tieton River near North Yakima, Wash., for 1904.

[Drainage area, 289 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	500	308	360	22,140	1.25	1.44
February	330	258	293	16,850	1.01	1.09
March	447	277	337	20,720	1.17	1.35
April	3,140	330	1,582	94,140	5.47	6.10
May	2,880	1,030	1,614	99,240	5.58	6.43
June	2,195	1,000	1,456	86,640	5.04	5.62
July	1,670	540	961	59,090	3.33	3.84
August	602	353	458	28,160	1.58	1.82
September	388	287	329	19,580	1.14	1.27
October	500	233	278	17,090	.962	1.11
November	1,210	220	413	24,580	1.43	1.60
December	540	287	357	21,950	1.24	1.43
The year	3,140	220	703	510,200	2.43	33.10

ATANUM CREEK NEAR YAKIMA, WASH.

This station was established May 11, 1904, by G. H. Bliss, for the purpose of studying the flow of the creek during the irrigating season. It is located at the Northern Pacific Railway Company's bridge, about 1 mile southeast of Yakima, Wash., 50 feet to the left of the road leading to the Yakima Indian Reservation. The station is three-fourths mile north of the gaging station on Yakima River at Union Gap. A plain staff gage, graduated to feet and tenths, is driven vertically into the bed of the creek and braced to the banks. It is read once each day by Hugh Kennedy. Discharge measurements are made from the downstream side of the railway bridge. The initial point for soundings is the face of the concrete abutment at the right bank. It is marked zero, and 5-foot intervals are marked across the bridge. The channel is straight for 50 feet above and below the station. The current is swift at high, and sluggish at low stages. The right bank is of medium height, clean, and not liable to overflow except at extremely high stages. The left bank is low, clean, and liable to overflow. The bed of the stream is composed of mud, free from vegetation, and not liable to change. There is but one channel

at all stages, broken by one pier. The bench mark is a point on the upstream edge of the top of the center pier of the railway bridge. Its elevation is 11.85 feet above the zero of the gage. The station was discontinued November 30, 1904.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Atanum Creek near Yakima, Wash., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 26	G. H. Bliss	127	4.45	6.63	565
July 1	J. C. Dry	47	3.08	4.90	145
July 18	do	38	2.22	4.40	84
August 11	do	18.2	.80	3.40	14.5
August 19	do	14.9	.73	3.38	10.9

Mean daily gage height, in feet, of Atanum Creek near Yakima, Wash., in 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6.3	4.9	3.7	3.3	3.0	3.2
2	.....	6.3	4.9	3.6	3.3	3.0	3.2
3	.....	6.1	4.9	3.6	3.3	3.0	3.2
4	.....	6.0	4.9	3.6	3.3	3.0	3.2
5	.....	6.1	5.0	3.6	3.3	3.0	3.2
6	.....	6.0	5.0	3.6	3.3	3.0	3.2
7	.....	6.0	5.0	3.6	3.3	3.0	3.2
8	.....	6.0	4.9	3.6	3.3	3.0	3.3
9	.....	6.0	4 9	3.6	3.0	3.0	3.3
10	.....	5.9	4.9	3.6	3.0	3.0	3.3
11	5.3	5.9	4.7	3.5	3.0	3.2	3.3
12	5.4	5.9	4.5	3.5	3.0	3.2	3.3
13	5.5	5.6	4.5	3.5	3.0	3.1	3.3
14	5.5	5.6	4.4	3 5	3.0	3.1	3.3
15	5.6	5.5	4.3	3.5	3.0	3.1	3.3
16	5.8	5.7	4.3	3.5	3.0	3.1	3.3
17	5.8	5.6	4.3	3.5	3.0	3.1	3.3
18	5.7	5.9	4.3	3.5	3.0	3.1	3.3
19	5.7	5.8	4.3	3.4	3.0	3.1	3.4
20	5 8	5 9	4.2	3.4	3.0	3.2	3.4
21	5.9	5.9	4.2	3.4	3.0	3.2	3.6
22	6.0	5.9	4.0	3.4	3.0	3.2	3.8
23	6.5	5.9	3.9	3.4	3.0	3.1	3.8
24	6.5	5.9	3.9	3.4	3.0	3.3	3.8
25	6.5	5.8	3.9	3.4	3.0	3.3	3.7
26	6.5	5.4	3.9	3.4	3.0	3.3	3.7
27	6.3	5.2	3.9	3.4	3.0	3.3	3.7
28	6.1	5.2	3.9	3.4	3.0	3.2	3.7
29	6.2	5.2	3.9	3.4	3.0	3.2	3.7
30	6.2	5.2	3.7	3.3	3.0	3.2	3.7
31	6.3	.....	3.7	3.3	.....	3.2	.....

NOTE.—Observations were made during irrigating season only.

Rating table for Atanum Creek near Yakima, Wash., from May 11 to November 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.00	0	4.10	58	5.10	176	6.10	425
3.10	2	4.20	66	5.20	196	6.20	451
3.20	6	4.30	74	5.30	218	6.30	477
3.30	10	4.40	83	5.40	243	6.40	503
3.40	14	4.50	93	5.50	269	6.50	529
3.50	18	4.60	104	5.60	295	6.60	555
3.60	23	4.70	116	5.70	321	6.70	581
3.70	29	4.80	128	5.80	347	6.80	607
3.80	35	4.90	142	5.90	373	6.90	633
3.90	42	5.00	158	6.00	399	7.00	659
4.00	50						

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements taken during 1904. It is well defined between gage heights 3.40 feet and 6.60 feet. The table has been extended beyond these limits. Above gage height 5.40 feet the rating curve is a tangent, the difference being 26 per tenth.

Estimated monthly discharge of Atanum Creek near Yakima, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 11–31	530	220	389	16,200
June	480	200	346	20,580
July	160	30	87.8	5,399
August	30	10	19.4	1,193
September	10	0	2.7	161
October	10	0	3.6	214
November	35	6	14.9	887
The period				44,630

CANALS IN THE YAKIMA RIVER VALLEY, WASHINGTON.

Nowhere in the State of Washington has irrigation been practiced longer or have matters pertaining to irrigation reached a higher state of development than in the Yakima Valley. The rapid fall of the rivers, the great fertility of the soil, and the climatic conditions have all served to bring this about.

The chief sources of water supply for canals used for irrigation are the Yakima and Naches rivers, the latter of which, when it joins the

Yakima, has already received the water of the Tieton. Besides these rivers the Wenas, Cowiche, Atanum, Toppenish, and Satus creeks, and some small creeks in the vicinity of Ellensburg, irrigate large areas of land lying in the valleys through which they flow. From these sources there are about 125,000 acres of land at present under irrigation, and with the available storage reservoirs at the head of the Yakima, Naches, and Tieton rivers, and with economy in the use of the water, it is probable that 300,000 additional acres of land could be irrigated.

There are at the present time about 50 irrigating canals in operation in the Yakima Valley, which obtain their water from the sources above mentioned, and irrigate the low land lying near the streams. This land is of volcanic origin, and very fertile. When water is applied, large and very profitable crops of fruit, hay, hops, and grain are raised.

There remains at the present time a large area of the best quality of land in the Yakima Valley unirrigated, but the available water supply, especially at the low stages of the streams, is practically exhausted, so that the irrigation of additional land is dependent upon stored water, to be used during about two and one-half months of the irrigating season.

There are five reservoir sites available for the storage of water in the Yakima region. These are Lake Clealum, Lake Kachess, and Lake Keechelus, at the head of Yakima River, Bumping Lake, at the head of Naches River, and McAlisters Meadows, on Tieton River.

The canals at present in operation in the Yakima Valley are mostly in the hands of stock companies, which, with but few exceptions, furnish the farmers under the canal water enough to supply all demands. Most farmers have taken from the ditches what water seemed most convenient for their use, which in many instances has been far in excess of the amount actually needed to irrigate their land economically and profitably. The results of this excessive use of water are only too apparent to those who have traveled through the oldest irrigated sections of the Yakima Valley. Land that was once valuable is now water-logged and worthless, alkali being everywhere visible.

The contracts of the best managed canals in the Yakima Valley allow 1 second-foot for 100 and 160 acres of land, which gives a total depth of water of 44 and 27 inches, respectively, over the land irrigated. From the figures which follow, it can be seen that nearly twice this amount was used during the season of 1904.

To determine more accurately the hydrographic conditions existing in the Yakima Valley, a systematic series of investigations were made during the irrigation season of 1904 under the direction of T. A. Noble,

district engineer, by G. H. Bliss, assisted by G. F. Harley. Not only were the former gaging stations on the Yakima, Naches, and Tieton rivers continued, but new stations were established at other controlling points on these rivers, and also upon all but the smallest canals taking water from them. In each case discharge measurements and daily gage readings were taken near the head works of the canals.

As a rule the irrigation season in the Yakima Valley opens about April 16 and closes about October 15, and estimates of discharge have been made for this period. In the tables of monthly discharge the flow for periods during which no gage readings were taken has been estimated. The maximum, minimum, and mean discharges are computed for periods during which water was actually flowing in the canal, the days when the water was shut off as noted in the table of gage heights not being considered. The "total in acre-feet" represents the entire discharge of the canal for the same periods. The figures for "depth in inches over the irrigated area" are computed from the run-off in acre-feet and no allowances are made for losses from waste or other causes. For a list of the canals, see table on page 165 et seq.

CASCADE CANAL NEAR THORP, WASH.

This is the first canal taking water from Yakima River. It heads in the river on its left bank in sec. 33, T. 19 N., R. 17 E., and has just been completed. Owing to the lateness of its completion no land was irrigated from it during the season of 1904. The canal is controlled by a cooperative association.

WEST KITTITAS CANAL NEAR THORP, WASH.

This canal heads in Yakima River on its right bank in sec. 33, T. 19 N., R. 17 E., about 3 miles northwest of Thorp. It is controlled by the West Kittitas Irrigation Company, a cooperative association.

Discharge measurements of West Kittitas canal near Thorp, Wash., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 17	Geo. F. Harley	25.8	2.07	1.91	53.5
September 23	do	20.5	1.77	1.48	36.3
September 23	do	18.4	1.78	1.32	32.5
September 23	do	.0	.00	.00	.0

NOTE.—Measured in a 14-foot flume.

Mean daily gage height, in feet, of West Kittitas canal near Thorp, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	(a)	1.58	2.33	2.00	17	1.92	1.75	1.92	.....	.....
2	.....	(a)	(a)	2.29	2.00	18	1.96	1.67	1.79	.....	.....
3	.....	(a)	(a)	2.25	.....	19	2 00	1 62	1.58	.....	.....
4	.....	1.67	2.04	2.17	.....	20	1.96	1.54	1.54	.....	.....
5	.....	1.83	2.04	2.17	.....	21	1.87	1.46	1.50	.....	.....
6	.....	1.83	1.96	2.17	.....	22	1.96	1.37	1.50	.....	.....
7	.....	1.67	1.92	(b)	.....	23	1.96	1.96	1.42	1.75	.....
8	.....	1.96	1.87	.....	.....	24	1.83	1.92	1.37	1.75	.....
9	.....	1.83	1.87	.....	.....	25	1.79	1.83	2.00	1.71	.....
10	.....	2.21	1.87	.....	.....	26	(a)	1.33	2.17	1.71	.....
11	.....	2.21	1.83	.....	.....	27	(a)	(a)	2.25	1.71	.....
12	.....	2.17	2.00	.....	.....	28	(a)	(a)	2.37	1.75	.....
13	.....	2.12	1.92	.....	.....	29	(a)	1.83	2.37	1.87	.....
14	.....	2.00	1.92	.....	.....	30	(a)	1.83	2.42	1.96	.....
15	.....	2.00	2.00	.....	.....	31	.....	1.67	2.42	.....	.....
16	.....	1.83	1.96	.....	.....						

a Water shut off.
b No record.

Rating table for West Kittitas canal near Thorp, Wash., from June 17 to October 2, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.00	0.0	0.65	9.9	1.30	30.5	1.95	53.9
.05	.5	.70	11.0	1.35	32.3	2.00	55.7
.10	1.1	.75	12.2	1.40	34.1	2.05	57.5
.15	1.7	.80	13.5	1.45	35.9	2.10	59.3
.20	2.3	.85	14.9	1.50	37.7	2.15	61.1
.25	3.0	.90	16.4	1.55	39.5	2.20	62.9
.30	3.7	.95	18.0	1.60	41.3	2.25	64.7
.35	4.5	1.00	19.7	1.65	43.1	2.30	66.5
.40	5.3	1.05	21.5	1.70	44.9	2.35	68.3
.45	6.1	1.10	23.3	1.75	46.7	2.40	70.1
.50	7.0	1.15	25.1	1.80	48.5	2.45	71.9
.55	7.9	1.20	26.9	1.85	50.3	2.50	73.7
.60	8.9	1.25	28.7	1.90	52.1		

The above table is based upon 4 discharge measurements made during 1904. It is not well defined. Above gage height 1.00 foot the rating curve is a tangent, the difference being 3.6 per tenth.

Mean daily discharge, in second-feet, of West Kittitas canal near Thorp, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1		(a)	41	68	56	17	52	47	52		
2		(a)	(a)	67	56	18	54	43	49		
3		(a)	(a)	65		19	56	41	41		
4		43	58	61		20	54	40	40		
5		50	58	61		21	50	36	38		
6		50	54	61		22	54	32	38		
7		43	52			23	54	54	34	47	
8		54	50			24	50	52	32	47	
9		50	50			25	49	50	56	45	
10		63	50			26	(a)	32	61	45	
11		63	50			27	(a)	(a)	65	45	
12		61	56			28	(a)	(a)	68	47	
13		59	52			29	(a)	50	68	50	
14		56	52			30	(a)	50	70	54	
15		56	56			31	(a)	43	70		
16		50	54								

a Water shut off.

Estimated monthly discharge of West Kittitas canal near Thorp, Wash., for 1904.

[Irrigated area, 7,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			50	1,488	2.54
May [a]			50	3,074	5.27
June [a b]			53	2,628	4.50
July [b]	63	32	48.8	2,517	4.30
August [c]	70	32	52.2	3,003	5.14
September [d]	68	45	55	3,273	5.60
October 1–15			56	1,666	2.85
The period	70	32	52	17,650	30.20

a Estimated.
b Water shut off 5 days.
c Water shut off 2 days.
d September 7–22 estimated.

TOWN CANAL NEAR ELLENSBURG, WASH.

This canal heads in the left bank of Yakima River about 9 miles northwest of Ellensburg, in sec. 7, T. 18 N., R. 18 E. The discharge was gaged June 16 and again August 5. About July 10 the canal was cleaned and considerable material which had been washed in was removed. On account of these changes of the channel the estimates of discharge are only approximate. The canal is controlled by a cooperative association.

Discharge measurements of Town canal near Ellensburg, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 16	G. F. Harley	20	61.2	2.06	4.15	126
August 5	do	20	58.3	2.19	3.75	128

Mean daily gage height, in feet, of Town canal near Ellensburg, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		4.08	3.67	3.75	17	4.17	3.83	3.83	3.50
2		4.08	3.67	3.67	18	4.17	3.83	3.83	3.46
3		4.08	3.67	3.71	19	4.25	3.67	3.83	3.46
4		4.08	3.67	3.67	20	(a)	3.67	3.92	3.42
5		4.08	3.75	3.67	21	(a)	3.67	3.92	
6		4.08	3.75	3.67	22	4.00	3.67	3.92	
7		4.08	3.75	3.71	23	4.00	3.67	3.92	
8		4.33	3.71	3.62	24	3.92	3.67	3.92	
9		4.33	3.71	3.62	25	4.08	3.67	3.83	
10		(a)	3.67	3.58	26	4.08	3.67	3.83	
11		(a)	3.67	3.58	27	4.08	3.75	3.83	
12		(a)	3.58	3.54	28	4.08	3.75	3.83	
13		(a)	3.58	3.50	29	4.08	3.75	3.83	
14		(a)	3.67	3.50	30	4.08	3.67	3.75	
15		(a)	3.67	3.50	31		3.67	3.75	
16	4.17	3.92	3.75	3.50					

a Water shut off.

Mean daily discharge, in second-feet, of Town canal near Ellensburg, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		122	120	128	17	126	132	132	112
2		122	120	120	18	126	132	132	110
3		122	120	127	19	129	120	132	110
4		122	120	120	20	(a)	120	136	108
5		122	128	120	21	(a)	120	136	
6		122	128	120	22	119	120	136	
7		122	128	127	23	119	120	136	
8		134	127	117	24	114	120	136	
9		134	127	117	25	122	120	132	
10		(a)	120	114	26	122	120	132	
11		(a)	120	114	27	122	128	132	
12		(a)	114	113	28	122	128	132	
13		(a)	114	112	29	122	128	132	
14		(a)	120	112	30	122	120	128	
15		(a)	120	112	31		120	128	
16	126	135	128	112					

a Water shut off.

Estimated monthly discharge of Town canal near Ellensburg, Wash., for 1904.

[Irrigated area, 8,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–31 [a]			100	2,975	4.46
May			110	6,764	10.2
June [b]	129	114	122	6,776	10.2
July [c]	135	120	124	6,150	9.23
August	136	114	127	7,809	11.7
September [a]	128	108	116	6,902	10.4
October 1–15 [d]			100	2,975	4.46
The period	136	108	116	40,350	60.6

[a] Estimated.
[b] Water shut off 2 days; estimated June 1–15.
[c] Water shut off 6 days.
[d] Estimated September 21–30.

OLSEN (OR MILL) DITCH NEAR ELLENSBURG, WASH.

This ditch heads in the left bank of Yakima River just below Town canal. It has under it about 1,200 acres of land, nearly all cultivated. A miscellaneous measurement taken August 5 gave a discharge of 14 second-feet.

SELAH-MOXEE CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Yakima River just below the Yakima Canyon in sec. 8, T. 14 N., R. 19 E. It is the next canal of importance below the Olsen (or Mill) ditch at Ellensburg. Measurements taken on the wasteways of the Selah-Moxee canal show that its direct waste into the river rarely exceeds 25 per cent of the water taken in at the headworks and often is practically nothing.

Discharge measurements of Selah-Moxee canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 26	G. H. Bliss	22	41	2.46	2.42	84
June 8	do	19	40	1.70	2.17	[a] 68
June 22	do	23	52	1.92	2.50	[b] 99
June 30	J. C. Dry	20	45	1.71	2.25	77
September 21	G. H. Bliss	19	37	1.37	([c])	51

[a] 10 second-feet wasting.
[b] 40 second-feet wasting.
[c] Measured below wasteway No 2.

Mean daily gage height, in feet, of Selah-Moxee canal near North Yakima, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.83	2.29	2.37	2.29	2.33	1.42
2	.....	2.58	2.25	2.37	2.21	2.33	1.42
3	.....	2.42	2.25	2.37	2.29	2.29	1.42
4	.....	2.33	2.25	2.37	2.37	2.29	1.42
5	.....	2.17	2.29	2.00	2.21	2.29	1.42
6	.....	2.08	2.37	2.29	2.25	2.29	1.42
7	.....	2.08	2.42	2.29	2.21	2.29	1.25
8	.....	1.79	2.17	2.21	2.17	2.33	.....
9	.....	1.58	2.04	2.21	2.21	2.33	.....
10	.....	1.42	1.04	2.12	2.29	2.33	.....
11	.....	2.21	2.21	2.04	2.17	2.33	.....
12	.....	2.21	2.29	2.00	2.29	2.33	.....
13	.....	2.21	2.21	2.04	2.29	2.33	.....
14	.....	2.25	2.08	2.12	2.25	2.33	.....
15	.....	2.29	2.08	2.00	2.29	2.33	.....
16	.....	2.29	2.33	1.92	2.29	2.29	.....
17	.....	2.25	2.25	2.00	2.29	2.29	.....
18	.....	2.21	2.37	2.00	2.29	2.25	.....
19	.....	2.25	2.42	2.04	2.29	2.25	.....
20	.....	2.25	2.46	2.17	2.29	2.25	.....
21	.....	2.29	2.46	2.12	2.29	2.25	.....
22	.....	2.46	2.50	2.12	2.29	2.25	.....
23	.....	2.46	2.37	2.12	2.37	2.25	.....
24	.....	2.42	2.37	2.21	2.37	2.17	.....
25	.....	2.33	2.25	2.21	2.32	2.17	.....
26	2.42	2.29	2.17	2.12	2.25	1.79	.....
27	2.00	2.25	2.08	2.21	2.29	1.42	.....
28	2.58	2.25	2.25	2.12	2.29	1.42	.....
29	2.67	2.33	2.29	2.21	2.33	1.42	.....
30	2.75	2.33	2.25	2.12	2.42	1.42	.....
31	.....	2.33	.....	2.12	2.33	.....	.....

Mean daily discharge, in second-feet, of Selah-Moxee canal near North Yakima, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	132	78	86	78	83	40
2	.....	107	75	86	73	83	40
3	.....	91	75	86	78	78	40
4	.....	81	75	86	86	78	40
5	.....	70	78	60	73	78	40
6	.....	65	86	78	75	78	40
7	.....	65	91	78	73	78	36
8	.....	52	68	73	70	83	.....
9	.....	46	62	73	73	83	.....
10	.....	40	31	67	78	83	.....
11	.....	73	73	63	70	83	.....
12	.....	73	78	60	78	83	.....
13	.....	73	73	63	78	83	.....
14	.....	75	65	67	75	83	.....
15	.....	78	65	60	78	83	.....
16	.....	78	82	57	78	78	.....
17	.....	75	75	60	78	78	.....
18	.....	73	86	60	78	75	.....
19	.....	75	91	63	78	75	.....

Mean daily discharge, in second-feet, of Selah-Moxee canal near North Yakima, Wash., for 1904—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
20	.....	75	95	70	78	75	.....
21	.....	78	96	67	78	75	.....
22	.....	95	99	67	78	75	.....
23	.....	95	86	67	86	75	.....
24	.....	91	86	72	86	70	.....
25	.....	82	75	72	83	70	.....
26	84	78	68	67	75	52	.....
27	60	75	65	73	78	40	.....
28	107	75	75	67	78	40	.....
29	116	82	78	73	83	40	.....
30	124	82	77	67	91	40	.....
31	.....	82	.....	67	83	.....	.....

Rating table for Selah-Moxee canal near North Yakima, Wash., from April 26 to October 7, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.35	39	1.80	52	2.20	72	2.60	109
1.40	40	1.85	54	2.25	75	2.65	114
1.45	41	1.90	56	2.30	79	2.70	119
1.50	42	1.95	58	2.35	84	2.75	124
1.55	43	2.00	60	2.40	89	2.80	129
1.60	44	2.05	63	2.45	94	2.85	134
1.65	46	2.10	66	2.50	99	2.90	139
1.70	48	2.15	69	2.55	104	2.95	144
1.75	50						

The above table is based upon five discharge measurements made during 1904. Above gage height 2.25 the table is well defined.

Estimated monthly discharge of Selah-Moxee canal near North Yakima, Wash., for 1904.

[Irrigated area, 6,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	.....	.....	98.0	2,916	5.83
May	132	40	77.8	4,784	9.57
June	99	31	76.9	4,576	9.15
July	86	57	69.5	4,273	8.55
August	91	70	78.2	4,808	9.62
September	83	40	72.6	4,320	8.64
October 1–15 [b]	.....	.....	39.0	1,160	2.32
The period	132	31	74.9	26,840	53.7

[a] Estimated April 16–25.

[b] Estimated October 8–15.

TAYLOR CANAL NEAR NORTH YAKIMA, WASH.

This is the next canal taking water from the Yakima below the Selah-Moxee canal. It heads in the right bank about 4 miles above the mouth of Naches River. The canal was built by the original owners of the adjacent land, and as they have disposed of their land they have included in the sale a water right which is understood to be 1 miner's inch per acre, though there is no accurate system of measuring the water used. Maintenance is carried on by assessments.

No station has been maintained on this canal. Two measurements were taken just below the headworks with the following results:

	Sec.-feet.
August 9, discharge	9
September 19, discharge	13

MOXEE AND HUBBARD CANALS NEAR NORTH YAKIMA, WASH.

The Moxee Company controls and operates these canals. They head in the Yakima River near the line between secs. 7 and 18 in T. 13 N., R. 19 E. Gaging stations were maintained on each canal, but the table of estimated monthly discharge is computed for the combined flow and the area irrigated by both canals. Very little water is wasted directly into the river by either of these canals.

Discharge measurements of Moxee canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Square ft.*	*Ft. per sec.*	*Feet.*	*Second-ft.*
May 20	G. H. Bliss	9	10.8	1.39	1.17	15
June 17	do	9	9.9	.91	1.08	9
September 3	J. C. Dry	9	15.0	.80	1.54	12

Mean daily gage height, in feet, of Moxee canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.37	1.14	1.33	1.58	1.04
2		1.37	(a)	1.44	1.58	1.06
3		1.37	(a)	1.37	1.54	.62
4		1.39	.83	1.37	1.54	.69
5		1.35	.81	(a)	1.62	.....
6		1.39	.92	(a)	1.50	.....
7		1.33	.94	1.44	1.54	.....
8		1.37	.92	1.50	1.54	.....
9		1.35	.92	1.46	1.56	.....
10		1.46	.95	1.53	1.50	.....
11		1.45	.92	1.46	1.49	.....
12		1.42	.90	1.53	1.50	.....
13		1.17	.88	1.56	1.46	.....
14		1.19	.98	1.50	1.46	.....

a Water shut off.

Mean daily gage height, in feet, of Moxee canal near North Yakima, Wash., for 1904—Cont'd.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
15	.....	1.06	1.14	1.48	1.45	.....
16	.....	1.07	.85	1.52	1.44	.....
17	.....	1.08	.91	1.54	1.44	.....
18	.....	1.12	.96	1.54	1.39	.....
19	.....	1.11	1.12	1.54	1.39	.....
20	1.17	1.09	1.15	1.60	1.39	.....
21	1.12	1.08	1.29	1.57	1.42	.....
22	1.21	1.04	1.36	1.56	1.50	.....
23	1.15	1.02	1.29	1.56	1.58	.....
24	1.17	.96	1.19	1.58	1.60	.....
25	1.21	1.17	1.17	1.67	1.25	.....
26	1.15	1.21	1.43	1.61	1.06	.....
27	1.29	1.17	1.35	1.65	1.04	.....
28	1.27	1.21	1.29	1.67	1.08	.....
29	1.29	1.23	1.27	1.74	1.08	.....
30	1.29	1.21	1.27	1.58	1.04	.....
31	1.23	.....	1.27	1.52	.....	.....

Mean daily discharge, in second-feet, of Moxee canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	28	13	25	40	6
2	.....	28	(a)	33	40	7
3	.....	28	(a)	28	39	1
4	.....	29	1	28	39	1
5	.....	26	1	(a)	42	.....
6	.....	29	2	(a)	36	.....
7	.....	25	2	33	39	.....
8	.....	28	2	36	39	.....
9	.....	26	2	33	39	.....
10	.....	33	3	38	39	.....
11	.....	33	2	33	34	.....
12	.....	31	2	38	36	.....
13	.....	15	1	39	34	.....
14	.....	16	4	36	34	.....
15	.....	7	12	34	33	.....
16	.....	8	1	37	32	.....
17	.....	9	2	39	32	.....
18	.....	11	2	39	29	.....
19	.....	10	12	39	29	.....
20	15	9	13	42	29	.....
21	11	8	23	40	32	.....
22	17	6	26	39	36	.....
23	13	5	23	39	40	.....
24	15	1	16	40	42	.....
25	17	15	15	47	20	.....
26	13	16	33	42	7	.....
27	23	15	26	45	6	.....
28	22	17	23	47	9	.....
29	23	19	22	51	9	.....
30	23	17	22	39	6	.....
31	19	.....	22	37	.....	.....

a Water shut off.

Discharge measurements of Hubbard canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 20	G. H. Bliss	12	20.0	1.50	1.92	30
June 17	do	12	17.6	1.14	1.66	20
June 17	do	12	14.5	1.17	1.42	17
September 3	J. C. Dry	12	18.5	1.29	1.78	24

Mean daily gage height, in feet, of Hubbard canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1.96	1.96	1.71	1.79	1.14
2	.....	1.94	2.12	2.02	1.79	1.14
3	.....	1.95	2.12	2.00	1.77	1.17
4	.....	1.95	1.74	1.95	1.73	1.15
5	.....	1.96	1.72	1.83	1.75	.....
6	.....	1.95	1.71	1.81	1.62	.....
7	.....	1.99	1.69	1.75	1.62	.....
8	.....	1.92	1.26	1.79	1.60	.....
9	.....	1.86	1.25	2.12	1.69	.....
10	.....	1.95	1.24	2.03	1.69	.....
11	.....	1.85	1.23	1.96	1.68	.....
12	.....	1.62	1.21	1.85	1.67	.....
13	.....	1.59	1.31	1.85	1.67	.....
14	.....	1.67	1.20	1.78	1.67	.....
15	.....	1.73	1.10	1.73	1.67	.....
16	.....	1.74	1.62	2.14	1.67	.....
17	.....	1.42	1.62	2.10	1.67	.....
18	.....	1.42	1.79	2.10	1.62	.....
19	.....	1.42	1.60	2.10	1.62	.....
20	1.92	1.39	1.71	2.12	1.33	.....
21	1.79	1.39	1.83	2.11	1.33	.....
22	1.85	1.95	1.87	1.98	1.33	.....
23	1.78	1.79	1.77	1.94	1.42	.....
24	1.79	1.04	1.62	1.87	1.42	.....
25	1.88	1.04	1.50	1.79	1.14	.....
26	1.79	1.77	1.98	1.73	1.14	.....
27	2.06	1.79	2.00	1.89	1.12	.....
28	2.05	1.81	2.00	1.92	1.12	.....
29	2.05	1.79	1.95	2.04	1.12	.....
30	2.05	1.79	1.87	1.83	1.14	.....
31	2.04	.....	1.87	1.79	.....	.....

Mean daily discharge, in second-feet, of Hubbard canal near North Yakima, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.
1	31	31	21	24	15	17	.....	17	19	42	20
2	31	42	34	24	15	18	.....	17	24	42	19
3	31	42	34	23	15	19	.....	17	19	42	19
4	31	23	31	23	15	20	28	17	21	42	16
5	31	21	26	23	.....	21	24	17	26	42	16
6	31	21	24	19	.....	22	26	31	26	34	16
7	34	21	23	19	.....	23	24	24	23	31	17
8	28	16	24	19	.....	24	24	15	19	26	17
9	26	16	42	21	.....	25	28	15	18	24	15
10	31	16	31	21	.....	26	24	23	34	23	15
11	26	16	31	21	.....	27	38	24	34	28	15
12	19	16	26	20	.....	28	38	24	34	28	15
13	19	16	26	20	.....	29	38	24	31	38	15
14	20	16	23	20	.....	30	38	24	26	26	15
15	23	15	23	20	.....	31	38	.....	26	24	.....
16	23	19	47	20	.....						

Rating table for Hubbard canal near North Yakima, Wash., from May 20 to October 4, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	14.9	1.35	16.3	1.65	20.2	1.95	31
1.05	15.0	1.40	16.8	1.70	21.2	2.00	34
1.10	15.1	1.45	17.3	1.75	22.6	2.05	38
1.15	15.3	1.50	17.8	1.80	24.2	2.10	42
1.20	15.5	1.55	18.4	1.85	26.0	2.15	47
1.25	15.7	1.60	19.2	1.90	28.2	2.20	53
1.30	16.0						

The above table is based upon four discharge measurements made during 1904. Above gage height 1.40 it is well defined.

Estimated monthly discharge of Moxee and Hubbard canals near North Yakima, Wash., for 1904.

[Irrigated area, 3,500 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	.....	.....	35.0	1,041	3.57
May	61	35	49.0	3,013	10.3
June	67	16	42.4	2,523	8.64
July	68	16	33.8	2,078	7.12
August	98	46	72.8	4,476	15.4
September	66	21	49.6	2,951	10.1
October 1–15	.....	.....	19	568	1.95
The period	98	16	45.9	16,650	57.1

[a] Estimated April 16 to May 19; also October 5–15.

FOWLER CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in Yakima River, in sec. 18, T. 13 N., R. 19 E. It is controlled by a stock company.

Discharge measurements of Fowler canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 20	G. H. Bliss	10	14.7	2.38	1.24	35.0
June 17	do	10	9.8	1.86	.75	18.2
September 3	J. C. Dry	10	13.7	2.18	1.20	29.1
September 3	do				.00	Dry.

Mean daily gage height, in feet, of Fowler canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.10	1.04	0.82	1.21	0.79
2		1.08	1.09	.89	1.19	.00
3		1.09	1.10	.81	1.17	.33
4		1.11	1.17	.71	1.17	.73
5		1.10	1.14	.85	1.17	
6		1.15	1.08	.83	1.21	
7		1.01	1.04	.60	1.21	
8		.98	1.04	.64	1.19	
9		.92	.92	1.00	1.29	
10		1.02	.88	1.00	1.33	
11		1.00	1.10	.96	1.31	
12		.98	1.04	.92	1.31	
13		.92	.71	.92	1.25	
14		.95	.54	.85	1.25	
15		1.00	.46	.92	1.24	
16		1.07	1.08	.92	1.21	
17		.78	1.04	.83	1.21	
18		.52	.92	.85	1.17	
19		.52	.83	.81	1.17	
20	1.24	.50	.88	1.06	1.21	
21	1.25	.50	.88	1.06	1.25	
22	1.32	.44	.88	1.04	1.25	
23	1.15	.65	.83	1.02	1.27	
24	1.14	.67	.75	1.00	1.27	
25	1.03	.69	.56	.98	1.29	
26	1.33	.62	1.00	.98	1.29	
27	1.21	.87	1.00	1.08	1.29	
28	1.20	1.00	.94	.0	.0	
29	1.21	.92	.89	.77	.0	
30	1.21	1.04	.82	1.21	.0	
31	1.19		.88	.0		

Mean daily discharge, in second-feet, of Fowler canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	29	27	20	32	20
2	.....	29	29	23	32	0
3	.....	29	29	20	30	7
4	.....	29	30	17	30	18
5	.....	29	30	21	30	.....
6	.....	30	29	21	32	.....
7	.....	26	27	14	32	.....
8	.....	26	27	15	32	.....
9	.....	23	23	26	35	.....
10	.....	26	23	26	37	.....
11	.....	26	29	24	35	.....
12	.....	26	27	23	35	.....
13	.....	23	17	23	34	.....
14	.....	24	12	21	34	.....
15	.....	26	10	23	34	.....
16	.....	27	29	23	32	.....
17	.....	20	27	21	32	.....
18	.....	11	23	21	30	.....
19	.....	11	21	20	30	.....
20	34	11	23	27	32	.....
21	34	11	23	27	34	.....
22	35	10	23	27	34	.....
23	30	15	21	26	34	.....
24	30	15	18	26	34	.....
25	27	17	12	26	35	.....
26	37	14	26	26	35	.....
27	32	21	26	29	35	.....
28	32	26	24	0	0	.....
29	32	23	23	20	0	.....
30	32	27	20	32	0	.....
31	32	.....	23	0	.....	.....

Rating table for Fowler canal near North Yakima, Wash., from May 20 to October 4, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.30	6.0	0.60	13.7	0.90	22.5	1.15	30.3
.35	7.2	.65	15.1	.95	24.0	1.20	31.9
.40	8.4	.70	16.5	1.00	25.5	1.25	33.5
.45	9.7	.75	18.0	1.05	27.1	1.30	35.1
.50	11.0	.80	19.5	1.10	28.7	1.35	36.7
.55	12.3	.85	21.0				

The above table is based upon 4 discharge measurements made during 1904. It is not well defined.

Estimated monthly discharge of Fowler canal near North Yakima, Wash., for 1904.

[Irrigated area, 2,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off, in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			25.0	744	4.46
May	37	27	34.0	2,091	12.6
June	30	10	22.0	1,309	7.85
July	30	10	23.6	1,451	8.71
August [b]	32	14	23.0	1,323	7.94
September [c]	37	30	33.0	1,767	10.6
October 1–15 [d e]			15.0	444	2.66
The period	37	10	25.9	9,129	54.8

[a] Estimated April 16 to May 19.
[b] Water shut off 2 days.
[c] Water shut off 3 days.
[d] Water shut off 1 day.
[e] Estimated October 5–15.

GRANGER CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in Yakima River in sec. 18, T. 13 N., R. 19 E. It is owned and operated by a private party and irrigates a small tract of land in the Moxee Valley. Owing to insufficient measurements no estimates of discharge were made for this canal.

Discharge measurements of Granger canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 20	G. H. Bliss	17	11.5	1.6	2.0	[a] 17.7

[a] Backwater in canal.

Mean daily gage height, in feet, of Granger canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.98	2.00	1.44	2.04	1.12
2		1.93	2.23	1.48	2.02	1.12
3		1.94	2.17	1.46	2.00	1.12
4		1.96	2.21	1.42	1.98	1.12
5		1.99	2.19	1.48	1.98	
6		2.01	2.14	1.46	2.02	
7		1.19	2.08	1.39	2.00	
8		1.17	2.12	1.42	2.00	
9		1.11	2.06	1.73	1.17	
10		1.12	2.02	1.71	1.17	
11		1.10	1.46	1.69	1.17	
12		1.10	1.46	2.57	1.14	
13		2.54	1.39	2.60	1.12	
14		2.57	1.35	2.58	1.12	

Mean daily gage height, in feet, of Granger canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
5	.....	2.62	1.35	1.79	1.12	.....
6	.....	2.10	1.42	1.93	1.12	.....
7	.....	2.50	1.36	1.85	1.12	.....
8	.....	2.52	1.37	1.85	1.12	.....
9	.....	2.52	1.35	1.83	1.08	.....
20	2.00	2.52	1.37	1.93	1.08	.....
21	2.00	2.54	1.37	1.87	1.08	.....
22	2.06	2.51	1.87	2.07	1.08	.....
23	1.73	2.48	1.85	2.06	1.10	.....
24	1.75	2.50	1.81	2.01	1.10	.....
25	1.75	2.56	1.81	1.96	1.10	.....
26	2.04	2.52	1.89	1.94	1.10	.....
27	2.00	2.52	1.94	2.00	1.12	.....
28	2.00	2.58	1.89	1.94	1.08	.....
29	2.00	2.02	1.85	2.12	1.12	.....
30	2.00	2.21	1.78	2.21	1.12	.....
31	1.99	.....	1.43	2.10	.....	.....

NEW RESERVATION CANAL NO. 2 IN YAKIMA INDIAN RESERVATION, WASH.

This is the first canal taking water from Yakima River below Atanum Creek. It was built by the Government to irrigate lands in the Yakima Indian Reservation. It heads in the right bank in sec. 17, T. 12 N., R. 19 E. Only about 4½ miles of the main canal had been constructed in 1904. The length of the main canal as proposed will be 65 miles, with three laterals aggregating 25 miles. The gradient is .03 per 100 feet, which causes a wash in some places.

Discharge measurements of New Reservation canal No. 2 in Yakima Indian Reservation, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 9	G. H. Bliss	40	17.5	1.00	0.41	17.7
June 7	do	40	40	1.10	.75	44
June 27	do	40	44	1.25	.95	55
July 22	J. C. Dry	40	54	1.53	1.17	82
August 19	do	40	40	1.30	.83	52

Mean daily gage height, in feet, of New Reservation canal No. 2 in Yakima Indian Reservation, for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	0.62	1.17	1.21	1.17	17	0.58	1.00	1.08	0.87	1.00
2	.....	.67	1.17	1.25	1.17	18	.58	1.00	1.08	.87	1.00
3	.....	.71	1.17	1.21	1.17	19	.67	.50	1.08	.83	1.00
4	.....	.71	1.17	1.29	1.17	20	.58	.83	1.17	.83	1.00
5	.....	.67	1.17	1.00	1.17	21	.67	.92	1.21	.83	1.00
6	.....	.67	1.17	1.29	1.17	22	.62	.92	1.19	.83	1.00
7	.....	.75	1.17	1.17	1.17	23	.75	.92	1.00	.83	.92
8	.....	.83	1.17	1.12	1.17	24	.71	.92	1.17	.83	.92
9	0.40	.75	1.08	1.00	1.17	25	.75	.92	1.17	.83	.92
10	.42	.75	1.08	1.00	1.17	26	.71	.92	1.12	.92	.83
11	.42	.77	1.08	.92	1.17	27	.67	.92	1.08	1.00	.83
12	.42	.75	1.08	.96	1.08	28	.67	.96	1.08	1.17	.83
13	.53	.83	1.08	.83	1.08	29	.67	1.00	1.17	1.50	.75
14	.53	.83	1.08	.92	1.08	30	.67	1.17	1.17	.75	.75
15	.53	1.00	1.08	.83	1.08	31	.67	.....	1.12	(a)	.....
16	.53	1.00	1.08	.75	1.08						

[a] Water shut off.

Mean daily discharge, in second feet, of New Reservation canal No. 2 in Yakima Indian Reservation, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	27	90	97	90	17	27	69	83	49	69
2	.....	30	90	104	90	18	27	69	83	49	69
3	.....	34	90	97	90	19	30	21	83	49	69
4	.....	34	90	121	90	20	27	49	90	49	69
5	.....	30	90	69	90	21	30	55	97	49	69
6	.....	30	90	121	90	22	27	55	97	49	69
7	.....	38	90	90	90	23	38	55	69	49	55
8	.....	49	90	83	90	24	34	55	90	49	55
9	17	38	83	69	90	25	38	55	90	49	55
10	17	38	83	69	90	26	34	55	83	55	49
11	17	38	83	55	90	27	30	55	83	69	49
12	17	38	83	62	83	28	30	62	83	90	49
13	24	49	83	49	83	29	30	69	90	149	38
14	24	49	83	55	83	30	30	90	90	38	38
15	24	69	83	49	83	31	30	.....	83	(a)	.....
16	24	69	83	38	83						

[a] Water shut off.

Rating table for New Reservation canal No. 2 in Yakima Indian Reservation, Wash., from May 9 to September 30, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.15	10	0.50	21	0.85	49	1.20	97
.20	11	.55	24	.90	55	1.25	104
.25	12	.60	27	.95	62	1.30	121
.30	13	.65	30	1.00	69	1.35	128
.35	15	.70	34	1.05	76	1.40	135
.40	17	.75	38	1.10	83	1.45	142
.45	19	.80	43	1.15	90	1.50	149

The above table is based upon 5 discharge measurements made during 1904. It is not well defined.

Estimated monthly discharge of New Reservation canal No. 2 in Yakima Indian Reservation, Wash., for 1904.

[Irrigated area, 2,700 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			20.0	595	2.64
May	38	17	27.0	1,660	7.38
June	90	21	49.1	2,922	13.0
July	97	63	86.4	5,312	23.6
August [b]	149	38	69.0	4,106	18.2
September	90	38	73.6	4,380	19.5
October 1–15 [c]			50.0	1,488	6.61
The period	149	21	56.4	20,460	90.9

[a] Estimated April 15 to May 8. [b] Water shut off 1 day. [c] Estimated.

OLD RESERVATION CANAL NO. 1 IN YAKIMA INDIAN RESERVATION, WASH.

This canal takes water from Yakima River, on its right bank, in sec. 28, T. 12 N., R. 19 E. It was built by the Government from an Indian fund derived from the sale of the Wenache fishery lands, which formerly belonged to the Indians.

Discharge measurements of Old Reservation canal No. 1 in Yakima Indian Reservation, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 9	G. H. Bliss	12	43	3.00	2.83	130
June 7	do	12	49	3.10	3.17	152
June 27	do	13	51	3.60	3.29	184
July 22	J. C. Dry	12	44	2.91	2.99	127
August 19	do	12	41	2.69	2.83	110

Mean daily gage height, in feet, of Old Reservation canal No. 1 in Yakima Indian Reservation Wash., for 1904.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1		3.37	3.17	12	2.06	3.33	3.08	22	3.17	2.92	3.17
2		3.33	3.25	13	2.06	3.33	3.08	23	3.17	2.96	3.17
3		3.33	3.27	14	2.06	3.29	3.08	24	3.25	2.92	3.17
4		3.35	3.25	15	2.00	3.29	3.04	25	3.25	2.21	3.17
5		3.33	3.29	16	2.07	3.25	3.00	26	3.17	2.21	3.17
6		3.35	3.17	17	2.06	3.25	3.00	27	3.33	2.25	3.17
7	3.17	3.35	3.17	18	3.02	3.17	2.92	28	3.33	2.17	3.17
8	3.00	3.33	3.17	19	3.02	3.21	2.83	29	3.33	2.17	3.17
9	3.00	3.33	3.12	20	3.02	3.12	2.83	30	3.33	2.12	3.17
10	3.00	3.33	3.08	21	3.02	3.00	3.17	31		2.08	3.17
11	3.02	3.33	3.08								

Mean daily discharge, in second-feet, of Old Reservation canal No. 1 in Yakima Indian Reservation, Wash., for 1904.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1		214	152	12	112	200	143	22	152	133	152
2		200	167	13	112	200	143	23	152	136	152
3		200	170	14	112	170	143	24	167	133	152
4		205	167	15	111	170	140	25	167	115	152
5		200	170	16	112	167	139	26	149	115	152
6		205	152	17	112	167	139	27	190	116	152
7	152	205	152	18	138	152	133	28	190	114	152
8	139	200	152	19	138	158	130	29	190	114	152
9	139	200	145	20	138	145	130	30	190	113	152
10	139	200	143	21	138	139	152	31		112	152
11	138	200	143								

Estimated monthly discharge[a] of Old Reservation canal No. 1 in Yakima Indian Reservation, Wash., for 1904.

[Irrigated area, 8,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off, in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30[b]			100	2,975	4.46
May			130	7,993	12.0
June	190	111	145	8,628	12.9
July	214	112	164	10,080	15.1
August	170	130	149	9,162	13.7
September			100	5,950	8.92
October 1–15[c]			90	2,678	4.01
The period	214	111	130	47,470	71.1

[a] Approximate. [b] Estimated April 15 to June 6. [c] Estimated September 1 to October 15.

GOVERNMENT CANAL NO. 3 NEAR TOPPENISH, WASH.

This canal heads in Yakima River in sec. 28, T. 11 N., R. 20 E., near Toppenish. Like the Old Reservation canal, it was built from a fund derived from the sale of the Wenache fisheries. It irrigates about 2,300 acres in the Yakima Indian Reservation. No water was ever appropriated for it. Its average flow is about 10 second-feet.

SUNNYSIDE CANAL NEAR YAKIMA, WASH.

This canal, which is owned and operated by the Washington Irrigation Company, takes water from the east bank of Yakima River, in sec. 28, T. 12 N., R. 19 E., nearly opposite the intake of the Old Reservation canal No. 1. It is several times larger than any other canal in the Yakima region, the maximum flow being about 630 second-feet. Six discharge measurements were taken at the headworks during the summer. Miscellaneous measurements and gage readings were taken at eight other places along the canal, for the purpose of obtaining seepage and wastage from the canal. The latter never exceeded 2 per cent, and very little of this amount found its way directly to the river. On June 10 a seepage experiment was made upon a stretch of the canal extending from the headworks to Zillah, a distance of 17 miles. The result showed a seepage loss of 4.5 per cent in this distance. Previous to this experiment all the laterals leading from the canal were closed and the canal allowed to regulate itself for twelve hours. The measurements at the beginning and end of the stretch were both taken by the same meter, and all chances of error eliminated. The section experimented upon is the oldest section of the canal, excavated in very fine volcanic soil. There has also

been deposited from time to time a fine silt of a clayish nature, which serves to make the banks more or less impervious to water. The first experiment was checked upon August 15, by a similar test over the same section, with the finding of a loss of 4 per cent due to seepage.

It is interesting to compare this with a seepage test made upon the first 9 miles of the Kennewick canal later, where the loss due to seepage was found to be 26 per cent. (See p. 138.)

The value of the water right on the basis of a duty of 160 acres per second-foot is $30 per acre. The value of the land, with the water right attached, is $60 to $90 per acre.

Discharge measurements of Sunnyside canal near Yakima, Wash., in 1904.

Date.	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 22	G. H. Bliss	153	3.05	2.54	467
May 26	do	184	3.00	3.18	553
June 10	do	160	3.04	2.79	[a] 487
July 2	G. F. Harley	202	3.12	3.62	630
August 15	G. H. Bliss	192	2.93	3.33	[b] 564
August 16	do	206	3.09	3.50	[c] 636

[a] 4.5 per cent seepage in 17 miles.
[b] 4 per cent seepage in 17 miles.
[c] Integration method at bridge.

Mean daily gage height, in feet, of Sunnyside canal near Yakima, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		2.96	3.25	3.54	3.46	3.37	2.58
2		2.96	3.25	3.62	3.46	3.37	2.58
3		2.96	3.25	([a])	3.46	3.37	2.58
4		2.96	3.25	([a])	3.46	3.37	2.54
5		2.96	3.25	([a])	3.50	3.37	2.52
6		3.04	3.25	([a])	3.54	3.35	2.50
7		3.04	3.25	([a])	3.54	3.33	2.50
8		3.04	3.21	2.17	3.54	3.29	2.50
9		3.04	2.79	2.65	3.54	3.29	2.50
10		2.00	2.79	3.29	3.54	3.29	2.46
11		3.04	3.12	3.33	3.54	3.29	2.33
12		3.04	3.12	3.37	3.54	3.25	2.33
13		3.04	3.06	3.41	3.55	3.12	2.33
14		3.04	3.06	3.46	3.56	3.08	2.29
15		3.04	3.14	3.46	3.33	3.04	2.29
16		3.10	3.17	3.46	3.58	2.79	.....
17		3.08	3.19	3.46	3.56	2.79	.....
18		3.10	3.29	3.46	3.56	2.79	.....
19		3.12	3.29	3.46	3.56	2.79	.....
20		3.12	3.29	3.46	3.56	2.79	.....
21		3.12	3.33	3.46	3.56	2.79	.....

[a] Water shut off.

Mean daily gage height, in feet, of Sunnyside canal near Yakima, Wash., for 1904—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
22	2.54	3.12	3.35	3.46	3.56	2.79	.....
23	2.79	3.12	3.35	3.46	3.56	2.79	.....
24	2.83	3.12	3.42	3.46	3.56	2.75	.....
25	2.83	3.14	3.39	3.46	3.56	2.71	.....
26	2.83	3.18	3.54	3.46	3.56	2.71	.....
27	2.83	3.19	3.46	3.46	3.56	2.71	.....
28	2.90	3.25	3.46	3.46	3.56	2.62	.....
29	2.92	3.25	3.50	3.46	3.53	2.62	.....
30	2.95	3.25	3.54	3.46	3.50	2.62	.....
31	.....	3.25	.....	3.46	3.44	.....	.....

Mean daily discharge, in second-feet, of Sunnyside canal near Yakima, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	513	558	613	597	580	468
2	.....	513	558	629	597	580	468
3	.....	513	558	0	597	580	468
4	.....	513	558	0	597	580	464
5	.....	513	558	0	605	580	462
6	.....	525	558	0	613	576	460
7	.....	525	558	0	613	572	460
8	.....	525	552	433	613	565	460
9	.....	525	491	475	613	565	460
10	.....	419	491	565	613	565	456
11	.....	525	537	572	613	565	445
12	.....	525	537	580	613	558	445
13	.....	525	528	587	615	537	445
14	.....	525	528	597	617	531	442
15	.....	525	540	597	572	525	442
16	.....	534	545	597	621	491	.....
17	.....	531	548	597	617	491	.....
18	.....	534	565	597	617	491	.....
19	.....	537	565	597	617	491	.....
20	.....	537	565	597	617	491	.....
21	.....	537	572	597	617	491	.....
22	464	537	576	597	617	491	.....
23	491	537	576	597	617	491	.....
24	496	537	589	597	617	486	.....
25	496	540	583	597	617	481	.....
26	496	547	613	597	617	481	.....
27	496	548	597	597	617	481	.....
28	505	558	597	597	617	472	.....
29	508	558	605	597	617	472	.....
30	512	558	613	597	605	472	.....
31	.....	558	.....	597	593	.....	.....

Rating table for Sunnyside canal near Yakima, Wash., from April 22 to October 15, 1904.

Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	419	2.45	455	2.90	505	3.35	576
2.05	423	2.50	460	2.95	512	3.40	585
2.10	427	2.55	465	3.00	519	3.45	595
2.15	431	2.60	470	3.05	526	3.50	605
2.20	435	2.65	475	3.10	534	3.55	615
2.25	439	2.70	480	3.15	542	3.60	625
2.30	443	2.75	486	3.20	550	3.65	636
2.35	447	2.80	492	3.25	558	3.70	647
2.40	451	2.85	498	3.30	567	3.75	658

The above table is based upon 6 discharge measurements made during 1904. It is fairly well defined between gage heights 2.50 feet and 3.60 feet.

Estimated monthly discharge of Sunnyside canal near Yakima, Wash., for 1904.

[Irrigated area, 35,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	512	464	496	14,760	5.06
May	558	419	529	32,530	11.2
June	613	491	561	33,380	11.5
July [b]	629	433	585	30,170	10.3
August	617	572	610	37,510	12.9
September	580	472	524	31,180	10.7
October 1–15	468	442	456	13,570	4.65
The period	629	419	547	193,100	66.3

[a] Estimated April 16–21. [b] Water shut off 5 days.

GILBERT CANAL NEAR TOPPENISH, WASH.

This canal heads in a slough from Yakima River in sec. 19, T. 11 N., R. 20 E., in the Yakima Indian Reservation. It was built by an association of men who lease lands from the Indians. At the expiration of the lease the canal belongs to the land through which it runs. A large part, probably 50 per cent, of the water taken into the canal is wasted into sloughs which drain into the river. No appropriation of water has been made and no water right acquired.

Discharge measurements of Gilbert canal near Toppenish, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 9 [a]	G. F. Harley	14	23	2.30	1.60	53
September 6 [b]	do	7	7.6	1.62	1.04	12.3
September 6 [c]	do	6	2.9	.86	.40	2.5

[a] Main branch. [b] East branch. [c] West branch.

Mean daily gage height, in feet, of Gilbert canal (east branch) near Toppenish, Wash., for 1904.

Day.	June. [a]	July.	Aug.	Sept.	Day.	June. [a]	July.	Aug.	Sept.
1	1.79	1.75	1.42	1.25	17	1.83	1.33	1.67	.....
2	1.75	1.75	1.42	1.17	18	1.83	1.29	1.42	.....
3	1.75	1.75	1.37	1.08	19	1.79	1.29	1.58	.....
4	1.75	1.42	1.37	1.06	20	1.79	1.33	1.58	.....
5	1.75	1.42	1.33	1.05	21	1.83	1.50	1.42	.....
6	1.79	1.54	1.33	1.04	22	1.87	1.50	1.17	.....
7	1.79	1.67	1.33	.....	23	1.92	1.67	1.08	.....
8	1.67	1.42	1.50	.....	24	1.67	1.50	1.00	.....
9	1.62	1.25	1.50	.....	25	1.67	1.50	1.17	.....
10	1.58	1.25	1.75	.....	26	1.67	1.67	1.00	.....
11	1.58	1.25	1.71	.....	27	1.67	1.75	.96	.....
12	1.58	1.33	1.42	.....	28	1.67	1.75	.92	.....
13	1.58	1.33	1.33	.....	29	1.75	1.67	.92	.....
14	1.62	1.37	1.42	.....	30	1.75	1.67	1.25	.....
15	1.67	1.37	1.42	.....	31	.....	1.58	(b)	.....
16	1.79	1.33	1.50	.....					

[a] June 1 to 23, gage above the forks. [b] Water shut off.

Mean daily discharge, in second-feet, of Gilbert canal (east branch) near Toppenish, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	58	35	20	15	17	60	17	30	.....
2	57	35	20	14	18	60	16	20	.....
3	57	35	18	13	19	58	16	25	.....
4	57	20	18	13	20	58	17	25	.....
5	57	20	17	12	21	60	22	20	.....
6	58	23	17	12	22	62	22	14	.....
7	58	30	17	.....	23	65	30	13	.....
8	55	20	22	.....	24	30	22	12	.....
9	53	15	22	.....	25	30	22	14	.....
10	51	15	35	.....	26	30	30	12	.....
11	51	15	32	.....	27	30	35	11	.....
12	51	17	20	.....	28	30	35	11	.....
13	51	17	17	.....	29	35	30	11	.....
14	53	18	20	.....	30	35	30	15	.....
15	55	18	20	.....	31	.....	25	0	.....
16	58	17	22	.....					

Mean daily gage height, in feet, of Gilbert canal (west branch) near Toppenish, Wash., for 1904.

Day.	June.[a]	July.	Aug.	Sept.	Day.	June.[a]	July.	Aug.	Sept.
1	.....	1.33	1.00	0.58	17	.....	1.17	1.00	.....
2	.....	1.33	1.00	.50	18	.....	1.08	.92	.....
3	.....	1.33	1.00	.54	19	.....	1.17	1.00	.....
4	.....	1.17	1.00	.50	20	.....	1.17	1.00	.....
5	.....	1.17	1.00	.45	21	.....	1.00	.92	.....
6	.....	1.50	1.00	.40	22	.....	1.00	.67	.....
7	.....	1.42	1.00	.....	23	.....	1.08	.58	.....
8	.....	1.25	1.00	.....	24	1.33	1.00	.54	.....
9	.....	1.17	1.00	.....	25	1.33	1.00	.58	.....
10	.....	1.17	1.00	.....	26	1.33	1.00	.50	.....
11	.....	1.17	1.00	.....	27	1.33	1.08	.50	.....
12	.....	1.25	.92	.....	28	1.33	1.17	.50	.....
13	.....	1.25	.83	.....	29	1.37	1.17	.50	.....
14	.....	1.25	.92	.....	30	1.33	1.08	.58	.....
15	.....	1.25	.92	.....	31	.....	1.00	(b)	.....
16	.....	1.17	1.00	.....					

[a] June 1 to 23, gage above the forks.

[b] Water shut off.

Mean daily discharge, in second-feet, of Gilbert canal (west branch) near Toppenish, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	.....	35	12	4	17	.....	25	12	.....
2	.....	35	12	3	18	.....	19	9	.....
3	.....	35	12	3.5	19	.....	25	12	.....
4	.....	25	12	3.0	20	.....	25	12	.....
5	.....	25	12	2.6	21	.....	12	9	.....
6	.....	47	12	2.5	22	.....	12	5	.....
7	.....	41	12	.....	23	.....	19	4	.....
8	.....	30	12	.....	24	35	12	4	.....
9	.....	25	12	.....	25	35	12	4	.....
10	.....	25	12	.....	26	35	12	3	.....
11	.....	25	12	.....	27	35	19	3	.....
12	.....	30	9	.....	28	35	25	3	.....
13	.....	30	7	.....	29	36	25	3	.....
14	.....	30	9	.....	30	35	19	4	.....
15	.....	30	9	.....	31	.....	12	0	.....
16	.....	25	12	.....					

Estimated monthly discharge[a] of Gilbert canal near Toppenish, Wash., for 1904.

[Irrigated area, 3,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30[b]			25.0	744	2.98
May			40.0	2,460	9.84
June	71	51	58.9	3,505	14.0
July	71	34	47.9	2,945	11.8
August[c]	47	14	28.6	1,702	6.81
September[d]	19	15	17.0	1,012	4.05
October 1–15			10.0	298	1.19
The period	71	14	35.1	12,670	50.7

[a] Approximate.
[b] Estimated April 16 to May 31.
[c] Water shut off one day.
[d] Estimated September 7to October 15.

HATCH CANAL NEAR TOPPENISH, WASH.

This canal is also called the Alfalfa Siding canal. It heads in a slough from Yakima River on its right bank near Toppenish in sec. 30, T. 10 N., R. 21 E. The status of this canal as regards ownership and water rights is the same as that of the Gilbert canal above. No gaging station was maintained on it. Two discharge measurements were taken with the following results:

Discharge measurements of Hatch canal near Toppenish, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Second-feet.*
June 9	G. F. Harley	6	6.1	2.10	12.8
September 6	do	6	4.0	1.00	4.0

PROSSER FALLS IRRIGATION COMPANY'S POWER CANAL AT PROSSER, WASH.

This company pumps water from Yakima River at Prosser, to be used for domestic purposes and irrigation. The water is carried to the wheels of the pumps by a flume 12 feet wide and a mean depth of water of about 6 feet, carrying on an average 205 second-feet of water when both pumps are running. Most of this amount of water is only used for the power purposes, however, and is spilled directly back into the river and is immediately available for irrigation lower down the valley.

The pumping plant consists of two Smith-Vaile pumps, of two cylinders each, of inside diameter of 25 inches and length of stroke of 24 inches. Diameter of wheel, 52 inches.

The average amount of water pumped is about 15 second-feet, or only about 7 per cent of the amount passing through the flume.

Discharge measurements of Prosser Falls Irrigation Company's power canal at Prosser, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 30	G. F. Harley	12	108	1.93	22.44	210
July 26	do	12	71	2.94	19.05	209
August 11	do	12	55	4.03	17.65	222
September 10	do	12	49	3.96	17.20	194
September 17	G. H. Bliss	12	61	2.85	18.25	175

[a] Change in velocities due to change in stage of river.

Mean daily discharge, in second-feet, of Prosser Falls Irrigation Company's power canal at Prosser, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	210	216	205	194	209
2	.....	0	216	209	194	209
3	.....	0	216	200	194	209
4	.....	210	216	200	194	209
5	.....	210	216	200	194	209
6	.....	210	216	200	194	209
7	.....	210	216	200	194	209
8	.....	210	216	212	194	209
9	.....	210	216	212	194	209
10	.....	210	216	212	194	209
11	.....	210	212	212	194	.....
12	.....	210	212	212	194	.....
13	.....	210	212	212	194	.....
14	.....	210	212	212	194	.....
15	.....	210	212	210	194	.....
16	.....	210	212	210	194	.....
17	.....	210	210	200	194	.....
18	.....	216	210	200	194	.....
19	.....	216	210	200	194	.....
20	.....	216	210	194	194	.....
21	.....	216	210	194	194	.....
22	.....	216	210	194	194	.....
23	.....	216	209	194	194	.....
24	.....	216	209	194	194	.....
25	.....	220	209	194	194	.....
26	.....	220	209	194	194	.....
27	.....	220	209	194	194	.....
28	.....	220	209	194	200	.....
29	.....	220	204	194	200	.....
30	210	220	204	194	200	.....
31	210	.....	204	194	.....	.....

Estimated monthly discharge of Prosser Falls Irrigation Company's power canal at Prosser, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 16–30	.....	.....	190	5,653
May	.....	.....	210	12,910
June	220	210	214	12,730
July	216	204	212	13,040
August	212	194	201	12,360
September	200	194	195	11,600
October 1–15	209	209	209	6,218
The period	220	194	205	74,510

Mean daily discharge,[a] in second-feet, of Prosser Falls Irrigation Company's irrigating canal at Prosser, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	14.7	15.8	14.5	14.9	14.9
2	.....	(b)	15.8	14.5	14.9	14.9
3	.....	(b)	15.8	13.5	14.9	14.9
4	.....	14.9	15.8	13.5	14.9	14.9
5	.....	14.9	15.8	13.5	14.9	14.9
6	.....	14.9	15.8	13.5	14.9	14.9
7	.....	14.9	15.8	13.5	14.9	14.9
8	.....	14.9	15.8	14.5	14.9	14.9
9	.....	14.9	15.8	14.5	14.9	13.5
10	.....	14.9	15.8	14.5	14.9	13.5
11	.....	14.5	15.8	14.5	14.9	.....
12	.....	14.5	15.8	14.5	14.9	.....
13	.....	14.5	15.8	14.5	14.9	.....
14	.....	14.5	15.8	14.5	14.9	.....
15	.....	14.7	15.4	14.5	14.9	.....
16	.....	14.7	15.4	14.5	14.9	.....
17	.....	14.7	15.4	14.5	14.9	.....
18	.....	15.5	15.4	14.5	14.9	.....
19	.....	15.5	15.4	14.5	14.9	.....
20	.....	15.8	15.4	14.5	14.9	.....
21	.....	15.8	15.4	14.5	14.9	.....
22	.....	15.8	15.4	14.5	14.9	.....
23	.....	15.8	15.4	14.5	14.9	.....
24	.....	15.8	15.4	14.9	14.9	.....
25	.....	16.3	15.4	14.9	14.9	.....
26	.....	16.3	15.4	14.9	14.9	.....
27	.....	16.3	15.4	14.9	14.9	.....
28	.....	16.3	15.4	14.9	14.9	.....
29	.....	16.3	15.4	14.9	14.9	.....
30	14.5	16.3	15.4	14.9	14.9	.....
31	14.5	.....	15.4	14.9	.....	.....

[a] Computed from revolutions of the pumps.

[b] Pumps not running.

Estimated monthly discharge[a] of Prosser Falls Irrigation Company's irrigating canal at Prosser, Wash., for 1904.

[Irrigated area, 1,200 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30	.....	.....	14.5	431	4.31
May	.....	.....	14.5	892	8.92
June[b]	16.3	14.7	15.1	898	8.98
July	15.8	15.4	15.6	959	9.59
August	14.9	13.5	14.4	885	8.85
September	14.9	14.9	14.9	887	8.87
October 1–15	.....	.....	14.6	434	4.34
The period	16.3	13.5	14.8	5,386	53.9

[a] Included in discharge of Power canal. [b] Water shut off two days.

LEDBETTER CANAL NEAR PROSSER, WASH.

This canal heads into Yakima River, above the falls at Prosser, just opposite the intake of the Prosser Falls Irrigation Company's flume. The canal has never been completed, and that part of it which had already been constructed has been allowed to fall into a dilapidated condition.

The proposed canal contemplated the irrigation of about 125,000 acres of land lying north and east of the Rattlesnake Range in the Columbia Valley and 25,000 acres additional lying upon the right bank of Yakima River above that covered by the Kennewick canal.

During the season of 1904 there were 3 or 4 miles in use by farmers who maintained it for the benefits derived, and a total acreage covered of about 360 acres.

No measurements were taken upon the canal.

KIONA CANAL NEAR KIONA, WASH.

This canal heads in the left bank of Yakima River about 4 miles west of Kiona in sec. 10, T. 9 N., R. 26 E. The canal is controlled by the Northern Pacific Irrigation Company. On account of the shifting of the channel at the gaging station the estimates of discharge of this canal are only approximate. Less than 5 per cent of the water taken in at the head-gates was wasted directly into the river.

Discharge measurements of Kiona canal near Kiona, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
April 14	G. H. Bliss	8	7.4	1.37	1.10	10.2
June 3	G. F. Harley	8	14.2	1.41	2.55	20.1
September 8	do	8	13.5	1.11	2.60	15.0

Mean daily gage height, in feet, of Kiona canal near Kiona, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.52	2.58	2.67	2.67	17	2.50	2.42	2.54	2.71	.....
2	.....	2.58	2.67	2.67	2.75	18	2.50	2.33	2.50	2.71	.....
3	.....	2.67	2.58	2.67	2.83	19	2.54	2.50	2.46	2.71	.....
4	.....	(a)	2.50	2.67	2.71	20	2.56	2.50	2.46	2.71	.....
5	.....	2.67	2.44	2.67	2.71	21	2.62	2.50	2.46	2.71	.....
6	.....	2.64	2.42	2.67	2.71	22	2.60	2.46	2.50	2.75	.....
7	2.62	2.64	2.42	2.67	2.71	23	2.58	2.42	2.54	2.79	.....
8	2.62	2.64	2.44	2.67	2.71	24	2.58	2.33	2.62	2.67	.....
9	2.54	2.62	2.46	2.67	2.71	25	2.58	2.50	2.67	2.67	.....
10	2.50	2.62	2.39	2.67	2.71	26	2.50	2.58	2.67	2.67	.....
11	2.48	2.62	2.39	2.67	2.71	27	2.42	2.62	2.67	2.67	.....
12	2.37	2.60	2.33	2.71	2.71	28	2.50	2.62	2.67	2.67	.....
13	2.33	2.58	2.33	2.71	2.71	29	2.50	2.54	2.67	2.67	.....
14	2.50	2.58	2.33	2.71	2.71	30	2.50	2.56	2.67	2.67	.....
15	2.50	2.54	2.54	2.71	2.71	31	.....	2.56	2.67	.....	.....
16	2.50	2.54	2.54	2.71	2.71						

[a] Water shut off.

Mean daily discharge, in second-feet, of Kiona canal near Kiona, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	20	21	19	19	17	20	18	20	21	.....
2	.....	21	24	19	23	18	20	17	20	21	.....
3	.....	24	21	19	25	19	20	20	19	21	.....
4	.....	0	20	19	21	20	21	20	19	21	.....
5	.....	24	18	19	21	21	23	20	19	21	.....
6	.....	24	18	19	21	22	22	19	20	23	.....
7	23	24	18	19	21	23	21	18	20	24	.....
8	23	24	18	19	21	24	21	17	16	19	.....
9	20	23	19	19	21	25	21	20	19	19	.....
10	20	23	17	19	21	26	20	21	19	19	.....
11	19	23	17	19	21	27	18	23	19	19	.....
12	18	22	17	21	21	28	20	23	19	19	.....
13	17	21	17	21	21	29	20	20	19	19	.....
14	20	21	17	21	21	30	20	21	19	19	.....
15	20	20	20	21	21	31	.....	21	19	.....	.....
16	20	20	20	21	21						

Estimated monthly discharge of Kiona canal near Kiona, Wash., for 1904.

[Irrigated area, 800 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			17.0	506	7.59
May			20.0	1,230	18.4
June	23	17	20.0	1,190	17.8
July [b]	24	17	21.1	1,256	18.8
August	24	17	19.0	1,168	17.5
September	24	19	20.3	1,208	18.1
October 1–15	25	19	21.3	634	9.51
The period	25	17	19.9	7,192	107.7

[a] Estimated April 15 to June 6th. [b] Water shut off one day.

KIONA WATER SUPPLY COMPANY'S CANAL NEAR KIONA, WASH.

This canal heads in the left bank of Yakima River, just above Kiona. It is owned by a stock company of 150 shares. It is a power canal used to turn small irrigating wheels. Nearly all the water taken in at the head is returned to the river. The discharge as measured June 6 was 18.5 second-feet.

KENNEWICK CANAL NEAR KENNEWICK, WASH.

This canal is owned and operated by the Northern Pacific Irrigation Company. Next to the Sunnyside it is the largest irrigation canal in the Yakima Valley. It takes water from the Yakima River on its right bank just above Horn Rapids, about 11 miles north of Kiona, in sec. 3, T. 10 N., R. 27 E. Besides two measurements taken at the head-gates, various other points along the canal were measured in order to determine the amount of water wasted and the loss due to seepage. The water wasted directly into the river was found to be about 15 per cent of the discharge at the intake, of which about 10 per cent was spilled into Columbia River.

Careful measurements taken September 9 at two points 8 miles apart near the upper end of the canal showed a seepage of 26 per cent in this distance. All the laterals along this stretch had been tightly closed and the canal allowed to regulate itself before the measurements were made. Over the stretch tested the canal is excavated in sand and gravel for almost the entire distance, differing in this respect from the Sunnyside canal. The Kennewick canal is also of more recent construction.

Discharge measurements of Kennewick canal near Kennewick, Wash., in 1904.

Date	Hydrographer.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 4	G. F. Harley	58	1.65	2.71	96
September 9	do	75	1.64	3.20	123
September 9[a]	do	28	3.25	[b]2.10	91

[a] Seepage test, flume No. 1. [b] Gage in flume.

Mean daily gage height, in feet, of Kennewick canal near Kennewick, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.38	2.75	3.1	3.2	3.3	3.2
2	.....	2.38	2.75	3.1	3.2	3.2	3.2
3	.....	2.38	2.75	3.1	3.1	3.2	3.2
4	.....	2.38	2.75	3.1	3.3	3.2	3.2
5	.....	2.38	2.75	3.1	3.3	3.2	3.2
6	.....	2.38	2.75	3.1	3.3	3.2	3.2
7	.....	2.38	2.79	3.1	3.25	3.2	3.1
8	1.00	2.38	2.79	3.1	3.35	3.2	3.1
9	1.33	2.38	2.87	3.1	3.2	3.2	3.1
10	1.50	2.46	2.92	3.1	3.4	3.2	3.1
11	2.17	2.46	2.25	3.1	3.4	3.2	3.1
12	2.17	2.46	2.25	3.1	2.9	3.2	3.1
13	2.17	2.50	2.25	3.1	3.3	3.2	3.1
14	2.17	2.50	2.50	3.1	3.4	3.2	3.1
15	2.17	2.58	2.42	3.1	3.4	3.2	3.1
16	2.17	2.67	3.0	3.1	3.4	3.2	3.1
17	2.17	2.67	3.0	3.1	3.4	3.2	3.1
18	2.17	2.67	3.0	3.1	3.4	3.2	3.1
19	2.17	2.67	3.0	3.0	3.0	3.2	(a)
20	2.17	2.67	3.1	2.9	3.15	3.2	(a)
21	2.21	2.67	2.8	2.9	3.15	3.2	3.0
22	2.21	2.67	2.8	2.85	3.4	3.2	3.0
23	2.21	2.67	3.0	3.00	3.4	3.2	3.1
24	2.21	2.67	3.1	2.95	3.4	3.25	3.0
25	2.17	2.75	3.1	2.80	3.3	3.25	2.9
26	.83	2.75	3.1	2.75	3.3	3.25	2.9
27	1.00	2.75	3.1	2.75	3.25	3.25	3.0
28	2.50	2.75	3.1	2.60	3.2	3.25	3.0
29	2.50	2.75	3.1	2.70	3.3	3.2	2.9
30	2.50	2.75	3.1	2.90	3.3	3.2	2.9
31	.....	2.75	.....	3.00	3.2	.....	2.9

[a] Water shut off.

Mean daily discharge, in second-feet, of Kennewick canal near Kennewick, Wash., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	73	98	123	125	127	125
2	.....	73	98	123	125	125	125
3	.....	73	98	123	123	125	125
4	.....	73	98	123	127	125	125
5	.....	73	98	123	127	125	125
6	.....	73	98	123	127	125	125
7	.....	73	102	123	126	125	123
8	10	73	102	123	128	125	123
9	18	73	106	123	125	125	123
10	20	77	110	123	129	125	123
11	59	77	63	123	129	125	123
12	59	77	63	123	110	125	123
13	59	80	63	123	127	125	123
14	59	80	80	123	129	125	123
15	59	87	75	123	129	125	123
16	59	92	116	123	129	125	123
17	59	92	116	123	129	125	123
18	59	92	116	123	129	125	123
19	59	92	116	116	116	125	0
20	59	92	123	110	124	125	0
21	48	92	102	110	124	125	116
22	48	92	102	105	129	125	116
23	48	92	116	116	129	125	123
24	48	92	123	112	129	126	116
25	59	98	123	102	127	126	110
26	8	98	123	98	127	126	110
27	10	98	123	98	126	126	116
28	80	98	123	116	125	126	116
29	80	98	123	94	127	125	110
30	80	98	123	110	127	125	110
31	.....	98	.....	116	125	.....	110

Estimated monthly discharge of Kennewick canal near Kennewick, Wash., for 1904.

[Irrigated area, 6,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30	59	8	53.6	1,595	3.19
May	98	73	85.5	5,257	10.5
June	123	63	101	6,010	12.0
July	123	94	117	7,194	14.4
August	129	110	126	7,747	15.5
September	127	125	126	7,498	15.0
October 1–15	125	123	124	3,690	7.38
The period	129	8	107	38,990	78.0

GROSSCUP'S CANAL NEAR KIONA, WASH.

This canal is sometimes called the Lower Yakima canal. It heads into Yakima River upon its left bank, at Horn Rapids directly opposite the intake of the Kennewick canal. The same diversion weir is used for both canals, as is also the same water appropriation.

During the season of 1904, 5½ miles were constructed, but no water used for irrigation purposes. The canal as constructed is owned and operated by Mr. Grosscup. The Northern Pacific Irrigation Company, of whom the right of way was secured, reserve the right to extend the canal at any time and to supply the present owner with what water he needs.

SINCLAIR AND COBB CANAL NEAR NORTH YAKIMA, WASH.

There are no canals of any consequence taking water from Tieton River. A small irrigating canal heads in Tieton River on its left bank, about 3 miles above its mouth. It is owned and operated by Sinclair and Cobb, and carries about 5 second-feet of water. The total discharge of Tieton River therefore flows practically unused into Naches River.

SELAH VALLEY CANAL NEAR NORTH YAKIMA, WASH.

The only important canal taking water from Naches River above the mouth of the Tieton is the Selah Valley canal. There are a few canals above the Selah Valley, but they are small private ditches, and their combined flow would probably not exceed 15 second-feet.

The Selah Valley canal heads in Naches River on its left bank about 1 mile above the mouth of the Tieton in sec. 35, T. 15 N., R. 16 E. With the exception of the Powe canal it is the largest canal taking water from the Naches. The canal ends in the sandy prairie some distance from the river. The wasteways are for emergencies only. Very little water is wasted directly into the river.

Discharge measurements of Selah Valley canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 27	G. F. Harley	14	14.0	1.60	2.05	22.4
June 8	do	13	12.6	1.44	1.94	18.2
July 9	do	15	18.9	1.66	2.36	31.6
July 9	do	16	24.7	1.91	2.76	47.6
July 9	do	17	31.3	2.14	3.17	66.9
July 15	do	17	36.7	2.30	3.48	84.4
August 12	do	7	17.5	3.17	.....	[a] 54.4

[a] "Twin Flume" 5 miles below the head-gates.

Mean daily gage height, in feet, of Selah Valley canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	3.50	3.50	3.42	3.54	3.00
2	.....	3.50	3.50	3.50	3.54	3.00
3	.....	3.50	3.50	3.50	3.54	3.00
4	.....	3.50	3.50	3.50	3.54	3.00
5	.....	3.50	2.00	3.50	3.54	3.00
6	.....	3.50	2.00	3.50	3.54	3.00
7	.....	3.50	2.00	3.50	3.54	3.00
8	.....	3.50	2.00	3.50	3.54	3.00
9	.....	3.50	2.50	3.58	3.54	3.00
10	.....	3.50	2.67	3.58	3.54	3.00
11	.....	3.50	2.67	3.58	3.54	3.00
12	.....	3.50	2.83	3.50	3.54	3.00
13	.....	3.50	3.17	3.42	3.54	3.00
14	.....	3.42	3.50	3.58	3.54	3.00
15	.....	3.50	3.50	3.58	3.54	3.00
16	.....	3.50	3.33	3.58	3.54	.....
17	.....	3.50	3.25	3.58	3.50	.....
18	.....	3.50	3.42	3.58	3.50	.....
19	0.50	3.50	3.42	3.58	3.50	.....
20	0.50	3.50	3.50	3.58	3.33	.....
21	2.33	3.50	3.50	3.58	3.33	.....
22	2.92	3.50	3.50	3.58	3.33	.....
23	3.17	3.42	3.50	3.58	3.33	.....
24	3.33	3.42	3.50	3.58	3.33	.....
25	3.17	3.42	3.50	3.58	3.33	.....
26	3.17	3.50	3.50	3.54	3.25	.....
27	3.33	3.50	3.50	3.54	3.17	.....
28	3.42	3.50	3.50	3.54	3.00	.....
29	3.42	3.50	3.50	3.54	3.00	.....
30	3.42	3.50	3.50	3.54	3.00	.....
31	3.50	.....	3.50	3.54	.....	.....

Mean daily discharge, in second-feet, of Selah Valley canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	84	84	79	87	60
2	.....	84	84	84	87	60
3	.....	84	84	84	87	60
4	.....	84	84	84	87	60
5	.....	84	20	84	87	60
6	.....	84	20	84	87	60
7	.....	84	20	84	87	60
8	.....	84	20	84	87	60
9	.....	84	37	89	87	60
10	.....	84	43	89	87	60
11	.....	84	43	89	87	60
12	.....	84	52	84	87	60
13	.....	84	79	79	87	60
14	.....	79	84	89	87	60
15	.....	84	84	89	87	60
16	.....	84	77	89	87	60

Mean daily discharge, in second-feet, of Selah Valley canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July	Aug.	Sept.	Oct.
17	.....	84	72	89	84	48
18	.....	84	79	89	84	43
19	2	84	79	89	84	43
20	2	84	84	89	77	.....
21	31	84	84	89	77	.....
22	55	84	84	89	77	.....
23	67	79	84	89	77	.....
24	77	79	84	89	77	.....
25	67	79	84	89	77	.....
26	67	84	84	87	72	.....
27	77	84	84	87	67	.....
28	79	84	84	87	60	.....
29	79	84	84	87	60	.....
30	79	84	84	87	60	.....
31	84	.....	84	87	.....	.....

Rating table for Selah Valley canal near North Yakima, Wash., from May 19 to October 15, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.80	15.1	2.30	29.7	2.75	47.6	3.20	69.4
1.85	16.3	2.35	31.4	2.80	49.9	3.25	71.8
1.90	17.6	2.40	33.1	2.85	52.3	3.30	74.3
1.95	19.0	2.45	34.9	2.90	54.7	3.35	76.7
2.00	20.4	2.50	36.8	2.95	57.1	3.40	79.2
2.05	21.9	2.55	38.8	3.00	59.6	3.45	81.6
2.10	23.4	2.60	40.9	3.05	62.0	3.50	84.1
2.15	24.9	2.65	43.1	3.10	64.5	3.55	86.5
2.20	26.5	2.70	45.3	3.15	66.9	3.60	89.0
2.25	28.1						

This table is based upon 6 discharge measurements made during 1904. It is well defined between gage heights 2.00 feet and 3.50feet. The table has been extended beyound these limits.

Estimated monthly discharge of Selah Valley canal near North Yakima, Wash., for 1904.

[Irrigated area, 6,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			45.0	1,339	2.68
May			59.0	3,511	7.04
June	84	79	83.3	4,957	9.91
July	84	20	69.5	4,273	8.55
August	89	79	86.7	5,331	10.7
September	87	60	80.8	4,808	9.62
October 1–15	60	60	60.0	1,785	3.57
The period	89	60	72.0	26,000	52.1

[a] Estimated April 16 to May 18.

WAPATOX CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the left bank of Naches River opposite the mouth of the Tieton in sec. 36, T. 15 N., R. 16 E. It is maintained by a stock company of 100 equal shares. Owing to the fact that the velocity of the current in the canal was greatly influenced by changes in the stage of the river and in the opening of the headgate, the canal was not accurately rated. The estimates of discharge are therefore only approximate.

Discharge measurements of Wapatox canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 19	G. F. Harley	9	3.46	0.62	0.42	2.2
July 8	do	9	12.3	.80	1.26	9.9
July 9	do	10	25.3	1.38	2.48	35.
July 16	do	10	19.34	1.45	1.90	27.9
July 28	do	10	22.0	1.50	2.19	33.

Mean daily gage height, in feet, of Wapatox canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.67	2.83	2.25	2.58	1.83
2	.....	2.67	2.75	2.25	2.58	1.83
3	.....	2.67	2.58	2.08	2.50	1.67
4	.....	2.67	2.67	2.00	2.50	1.67
5	.....	2.67	(a)	2.00	2.50	1.67
6	.....	2.67	(a)	2.17	2.50	1.67
7	.....	2.67	(a)	2.33	2.67	1.58
8	.....	2.67	(a)	2.33	2.67	1.50
9	.....	2.58	1.25	2.42	2.67	1.50
10	.....	2.50	2.42	2.33	2.67	1.67
11	.....	2.50	2.42	2.25	2.25	1.17
12	.....	2.50	2.33	2.17	2.25	1.17
13	.....	2.33	2.17	2.67	2.08	1.17
14	.....	2.33	1.83	2.83	2.08	1.17
15	.....	2.17	1.67	2.83	2.00	1.17
16	.....	2.25	1.83	2.83	2.00	1.17
17	.....	2.33	1.83	2.75	2.08	1.08
18	0.42	2.33	1.75	2.67	2.00	1.00
19	.33	2.33	1.92	2.67	2.00	1.00
20	2.33	2.33	1.83	2.67	2.00	.....
21	2.83	2.42	2.00	2.58	2.00	.....
22	3.00	2.42	2.33	2.50	2.00	.....
23	2.83	2.42	2.50	2.67	2.00	.....
24	2.50	2.42	2.33	2.67	1.92	.....
25	2.50	2.50	2.17	2.67	1.83	.....
26	2.67	2.50	2.17	2.67	1.83	.....
27	2.58	2.50	2.25	2.67	1.83	.....
28	2.58	2.67	2.25	2.75	1.83	.....
29	2.58	2.75	2.08	2.58	1.83	.....
30	2.67	2.83	2.00	2.58	1.83	.....
31	2.50	.....	2.17	2.58	.....	.....

a Water shut off.

Mean daily discharge, in second-feet, of Wapatox canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	41	45	31	39	21
2	.....	41	43	31	39	21
3	.....	41	39	27	37	18
4	.....	41	41	25	37	18
5	.....	41	0	25	37	18
6	.....	41	0	29	37	18
7	.....	41	0	33	41	15
8	.....	41	0	33	41	14
9	.....	39	10	35	41	14
10	.....	37	35	33	41	18
11	.....	37	35	31	31	9
12	.....	37	33	29	31	9
13	.....	33	29	41	27	9
14	.....	33	21	45	27	9
15	.....	29	18	45	25	9
16	.....	31	21	45	25	9
17	.....	33	21	43	27	8

Mean daily discharge, in second-feet, of Wapatox canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
18	1	33	19	41	25	7
19	1	33	23	41	25	7
20	33	33	21	41	25	.....
21	45	35	25	39	25	.....
22	49	35	33	37	25	.....
23	45	35	37	41	25	.....
24	37	35	33	41	23	.....
25	37	37	29	41	21	.....
26	41	37	29	41	21	.....
27	39	37	31	41	21	.....
28	39	41	31	43	21	.....
29	39	43	27	39	21	.....
30	41	45	25	39	21	.....
31	37	.....	29	39	.....	.....

Estimated monthly discharge of Wapatox canal near North Yakima, Wash., for 1904.

[Irrigated area, 1,400 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			20.0	595	5.10
May			40.0	2,460	21.1
June	45	29	37.2	2,214	19.0
July [b]	45	10	29.0	1,553	13.3
August	45	25	37.0	2,275	19.5
September	41	21	26.1	1,553	13.3
October 1–15	21	9	14.8	440	3.77
The period	45	9	31.2	11,090	95.1

[a] Estimated April 15–May 17. [b] Water shut off four days.

SMALL CANALS.

Below the Wapatox and above the Yakima Valley canal a group of small canals take water from both banks of Naches River. They are the Cox, Upper Scott, Lower Scott, Fortune, and Laswell canals on the right bank, and the Clark, Lowery, and Kelly canals on the left bank.

Below the intake of the Yakima Valley canal and above Cowiche Creek six more small ditches head into Naches River, namely: The Morrissey, White and Leach, McCormick, and Shearer and Chapman ditches on the left bank, and the two Rhodenbach Schuler ditches on the right bank.

For data concerning these canals see tables on pages 167–169.

GLEED CANAL NEAR NORTH YAKIMA, WASH.

This is the next large canal below the Wapatox. It is owned by the Naches Canal Company. Its intake is on the left bank of the Naches River about 11 miles from North Yakima in sec. 24, T. 14 N., R. 17 E. Just below the head-gates and below the rating station the canal forks. The lower lateral is owned by an association of farmers who irrigate 400 acres from it, and help maintain the main canal above the fork. This 400 acres is not included in the 1,400 irrigated by the Gleed canal.

Discharge measurements of Gleed canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq.-feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 19	G. F. Harley	14	39	1.96	2.41	74
July 9	do	14	23	1.09	1.08	25
August 30	J. C. Dry	14	35	1.40	2.04	49

Mean daily gage height, in feet, of Gleed canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.00	2.58	2.50	2.17	1.33
2	.....	2.33	2.58	2.50	2.17	1.33
3	.....	2.33	2.58	2.50	2.08	1.33
4	.....	2.33	2.58	2.50	2.08	.....
5	.....	2.33	1.00	2.50	2.00	.....
6	.....	2.25	1.17	2.50	1.83	.....
7	.....	2.25	1.33	2.42	1.83	.....
8	.....	2.33	1.33	2.42	2.00	.....
9	.....	2.33	1.33	2.50	2.00	.....
10	.....	2.25	1.17	2.42	2.00	.....
11	.....	2.25	1.08	2.42	2.00	.....
12	.....	2.17	1.67	2.42	1.75	.....
13	.....	2.25	1.83	2.42	1.75	.....
14	.....	2.25	1.83	2.42	1.75	.....
15	.....	2.25	1.83	2.42	1.50	.....
16	.....	2.17	1.83	2.42	1.50	.....
17	.....	2.17	1.83	2.42	1.33	.....
18	.....	2.33	1.75	2.33	1.33	.....
19	2.42	1.83	1.92	2.33	1.33	.....
20	2.50	1.83	2.00	2.33	1.33	.....
21	2.58	2.00	2.00	2.25	1.33	.....
22	2.67	2.00	2.25	2.21	1.33	.....
23	2.00	2.00	2.25	2.17	1.33	.....
24	2.25	2.00	2.33	2.17	1.33	.....
25	2.17	1.83	2.33	2.17	1.33	.....
26	2.33	1.67	2.50	2.17	1.33	.....
27	2.33	1.67	2.50	2.08	1.33	.....
28	2.42	2.25	2.50	2.08	1.33	.....
29	1.00	2.50	2.50	2.00	1.33	.....
30	1.00	2.58	2.50	2.00	1.33	.....
31	2.50	.....	2.50	2.17	.....	.....

Mean daily discharge, in second-feet, of Gleed canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	52	86	80	59	28
2	.....	71	86	80	59	28
3	.....	71	86	80	56	28
4	.....	71	86	80	56	.....
5	.....	71	21	80	52	.....
6	.....	65	24	80	46	.....
7	.....	65	28	74	46	.....
8	.....	71	28	74	52	.....
9	.....	71	28	80	52	.....
10	.....	65	24	74	52	.....
11	.....	65	23	74	52	.....
12	.....	59	38	74	42	.....
13	.....	65	46	74	42	.....
14	.....	65	46	74	42	.....
15	.....	65	46	74	32	.....
16	.....	59	46	74	32	.....
17	.....	59	46	74	28	.....
18	.....	71	42	71	28	.....
19	74	46	48	71	28	.....
20	80	46	52	71	28	.....
21	86	52	52	65	28	.....
22	89	52	65	62	28	.....
23	52	52	65	59	28	.....
24	65	52	71	59	28	.....
25	59	46	71	59	28	.....
26	71	38	80	59	28	.....
27	71	38	80	56	28	.....
28	74	65	80	56	28	.....
29	21	80	80	52	28	.....
30	21	86	80	52	28	.....
31	80	.....	80	59	.....	.....

Rating table for Gleed canal near North Yakima, Wash., from May 19 to October 3, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	21	1.45	30	1.90	48	2.35	71
1.05	22	1.50	32	1.95	50	2.40	74
1.10	23	1.55	34	2.00	52	2.45	77
1.15	24	1.60	36	2.05	54	2.50	80
1.20	25	1.65	38	2.10	56	2.55	83
1.25	26	1.70	40	2.15	59	2.60	86
1.30	27	1.75	42	2.20	62	2.65	89
1.35	28	1.80	44	2.25	65	2.70	92
1.40	29	1.85	46	2.30	68	2.75	95

The above table is based upon 3 discharge measurements made during 1904. It is well defined between gage heights 1.00 foot and 2.50 feet.

Estimated monthly discharge of Gleed canal near North Yakima, Wash., for 1904.

[Irrigated area, 1,800 acres [a].]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [b]			40.0	1,190	7.94
May			65.0	3,997	26.6
June	86	38	61.1	3,636	24.2
July	86	21	55.9	3,437	22.9
August	80	52	69.4	4,267	28.4
September	59	28	38.8	2,309	15.4
October 1–15 [c]			28.0	833	5.55
The period	86	21	54.2	19,670	131.0

[a] Includes 400 acres under the lower lateral.
[b] Estimated April 15–May 18.
[c] Estimated September 4–15.

YAKIMA VALLEY CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in the right bank of the Naches River about three-fourths mile below the intake of the Gleed canal in sec. 24, T. 14 N., R. 17 E. It extends by flume to Cowiche Creek, which is crossed by an inverted siphon of two pipes. It irrigates land north and west of North Yakima. The canal is the property of a cooperative company of 4,200 shares, or 1 share for each acre under the canal.

Discharge measurements of Yakima Valley canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 14	G. H. Bliss	9	20.2	2.55	1.71	51.4
June 30	G. F. Harley	9	15.9	2.42	1.37	38.5
July 20	J. C. Dry	9	19.6	3.11	1.92	61.1
August 13	G. F. Harley	9	23.3	3.29	2.13	79.0

Mean daily gage height, in feet, of Yakima Valley canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.60	1.81	1.92	2.00	2.12	1.64
2	1.58	1.81	1.92	2.04	2.10	1.64
3	1.56	1.83	1.92	2.04	2.08	1.64
4	1.37	1.83	1.87	2.08	2.04	1.64
5	1.39	1.83	1.87	2.08	2.00	1.62
6	1.25	1.83	(a)	2.08	2.00	1.50
7	1.08	1.79	(a)	2.08	2.00	1.50
8	1.04	1.79	(a)	2.08	2.00	1.48

[a] Water shut off.

Mean daily gage height, in feet, of Yakima Valley canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
9	1.33	1.75	1.71	2.08	2.00	1.33
10	1.54	1.73	1.75	2.12	2.00	1.33
11	1.56	1.71	1.75	2.08	2.00	1.50
12	1.60	1.71	1.92	2.12	2.00	1.48
13	1.62	1.71	1.96	2.12	1.87	1.48
14	1.71	1.67	1.92	2.12	1.87	1.46
15	1.71	1.67	1.92	2.12	1.87	1.25
16	1.71	1.67	1.92	2.12	1.83	.....
17	1.71	1.67	1.92	2.12	1.83	.....
18	1.71	1.67	1.92	2.12	1.83	.....
19	1.71	1.69	1.92	2.12	1.83	.....
20	1.69	1.75	1.92	2.12	1.83	.....
21	1.71	1.77	1.92	2.12	1.83	.....
22	1.67	1.79	1.92	2.12	1.83	.....
23	1.67	1.83	1.96	2.12	1.83	.....
24	1.71	1.85	1.96	2.14	1.83	.....
25	1.33	1.87	1.96	2.17	1.79	.....
26	1.71	1.92	1.96	2.17	1.79	.....
27	1.75	1.92	2.00	2.17	1.79	.....
28	1.75	1.94	2.00	2.17	.83	.....
29	1.79	1.92	2.00	2.17	.83	.....
30	1.81	(a)	2.00	2.17	.83	.....
31	1.79	.....	2.00	2.14	.....	.....

[a] Water shut off.

Mean daily discharge, in second-feet, of Yakima Valley canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	47	56	62	69	77	49
2	47	56	62	73	77	49
3	45	59	62	73	77	49
4	37	59	59	77	73	49
5	39	59	59	77	69	47
6	35	59	0	77	69	43
7	31	56	0	77	69	43
8	30	56	0	77	69	43
9	37	53	51	77	69	37
10	45	53	53	77	69	37
11	45	51	53	77	69	43
12	47	51	62	77	69	43
13	47	51	65	77	59	43
14	51	49	62	77	59	41
15	51	49	62	77	59	35
16	51	49	62	77	59	.....
17	51	49	62	77	59	.....
18	51	49	62	77	59	.....
19	51	51	62	77	59	.....
20	51	53	62	77	59	.....
21	51	53	62	77	59	.....
22	49	56	62	77	59	.....
23	49	59	65	77	59	.....
24	51	59	65	81	59	.....

Mean daily discharge, in second-feet, of Yakima Valley canal near North Yakima, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
25	37	59	65	81	56	.....
26	51	62	65	81	59	.....
27	53	62	69	81	59	.....
28	53	65	69	81	29	.....
29	56	62	69	81	29	.....
30	56	0	69	81	29	.....
31	56	.....	69	81	.....	.....

Rating table for Yakima Valley canal near North Yakima, Wash., from May 1 to October 15, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.85	28.5	1.25	35	1.65	49	2.00	69
90	29	1.30	36	1.70	51	2.05	73
95	29.5	1.35	37	1.75	53	2.10	77
1.00	30	1.40	39	1.80	56	2.15	81
1.05	31	1.45	41	1.85	59	2.20	86
1.10	32	1.50	43	1.90	62	2.25	91
1.15	33	1.55	45	1.95	65	2.30	96
1.20	34	1.60	47				

The above table is based upon 4 discharge measurements made during 1904. It is well defined between gage heights 1.35 feet and 2.15 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Yakima Valley canal near North Yakima, Wash., for 1904.

[Irrigation area, 3,600 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]	.....	.....	40.0	1,190	3.97
May	56	30	46.8	2,878	9.59
June [b]	65	49	55.3	3,181	10.6
July [c]	69	51	62.5	3,471	11.6
August	81	69	77.5	4,765	15.9
September	77	29	60.8	3,618	12.1
October 1–15	49	35	43.4	1,291	4.30
The period	81	30	57.4	20,390	68.1

[a] Estimated. [b] Water shut off 1 day. [c] Water shut off 3 days.

NACHES-COWICHE CANAL NEAR NORTH YAKIMA, WASH.

The intake of this canal is on the right bank of the river just below Nelson's bridge at Painted Rocks, in sec. 9, T. 13 N., R. 18 E. About one-half mile below the intake the canal crosses Cowiche Creek and until about the middle of June takes nearly all its water from this source. The amount of water taken from the river gradually increases until about the 1st of August, after which date the entire flow of the canal is drawn from Naches River.

Discharge measurements of Naches-Cowiche canal near North Yakima, Wash., in 1904.

Date.	Hydrographer	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
May 4	G. F. Harley	8	15	2.13	2.63	32
May 14	G. H. Bliss	8	22	2.00	3.20	44
July 12	do	8	21	1.93	3.12	41
August 12	J. C. Dry	8	24	1.96	3.30	46

Mean daily gage height, in feet, of Naches-Cowiche canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	3.12	2.96	3.08	2.83	1.50
2	.....	3.12	3.00	1.02	2.83	1.50
3	.....	3.08	3.04	3.75	2.79	1.50
4	.....	3.15	3.04	3.92	2.79	1.50
5	.....	3.08	3.04	3.92	2.71	1.50
6	3.08	3.00	3.04	3.83	2.71	1.67
7	3.08	3.00	3.04	3.92	2.71	1.67
8	3.08	2.96	3.04	3.92	2.71	1.67
9	3.12	2.96	3.17	3.92	2.71	1.67
10	3.17	2.87	3.04	3.83	2.62	1.50
11	3.17	2.83	3.08	3.83	2.62	.....
12	3.17	2.75	3.17	3.92	2.62	.....
13	3.17	2.62	3.17	3.92	2.62	.....
14	3.21	2.50	3.17	3.92	2.45	.....
15	3.21	2.50	3.17	3.92	2.50	.....
16	3.04	2.50	3.17	3.92	2.50	.....
17	3.12	2.87	3.17	3.17	2.25	.....
18	3.12	3.12	3.17	3.17	2.12	.....
19	3.12	3.12	2.75	3.17	2.17	.....
20	3.17	3.17	2.75	3.21	2.17	.....
21	3.17	3.17	2.62	3.17	1.92	.....
22	3.17	3.17	2.62	3.17	1.92	.....
23	3.21	3.04	2.83	3.21	1.92	.....
24	3.17	3.04	2.83	3.17	1.92	.....
25	3.12	3.17	2.92	3.12	1.92	.....
26	3.15	3.17	2.92	3.12	1.50	.....
27	3.12	3.17	2.96	3.12	1.50	.....
28	3.17	3.17	2.96	3.12	1.50	.....
29	3.17	3.21	2.96	3.12	1.50	.....
30	3.17	3.25	3.08	3.08	1.50	.....
31	3.17	.....	3.08	3.12	.....	.....

Mean daily discharge, in second-feet, of Naches-Cowiche canal near North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	41	38	41	36	24
2	.....	41	39	23	36	24
3	.....	41	40	64	35	24
4	.....	41	40	70	35	24
5	.....	41	40	70	33	24
6	41	39	40	68	33	24
7	41	39	40	70	33	25
8	41	38	40	70	33	24
9	41	38	42	70	33	25
10	42	36	40	68	31	24
11	42	36	41	68	31	.....
12	42	34	42	70	31	.....
13	42	31	42	70	31	.....
14	44	30	42	70	30	.....
15	44	30	42	70	30	.....
16	40	30	42	70	30	.....
17	41	36	42	42	28	.....
18	41	41	42	42	26	.....
19	41	41	34	42	27	.....
20	42	42	34	44	27	.....
21	42	42	31	42	25	.....
22	42	42	31	42	25	.....
23	44	40	36	44	25	.....
24	42	40	36	42	25	.....
25	41	42	37	41	25	.....
26	42	42	37	41	24	.....
27	41	42	38	41	24	.....
28	42	42	38	41	24	.....
29	42	44	38	41	24	.....
30	42	45	41	41	24	.....
31	42	.....	41	41	.....	.....

Rating table for Naches-Cowiche canal near North Yakima, Wash., from May 6 to October 10, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	25.8	2.50	30.0	3.00	39	3.50	54
2.05	26.0	2.55	30.5	3.05	40	3.55	56
2.10	26.2	2.60	31	3.10	41	3.60	58
2.15	26.5	2.65	32	3.15	42	3.65	60
2.20	27.0	2.70	33	3.20	43	3.70	62
2.25	27.5	2.75	34	3.25	44	3.75	64
2.30	28.0	2.80	35	3.30	46	3.80	66
2.35	28.5	2.85	36	3.35	48	3.85	68
2.40	29.0	2.90	37	3.40	50	3.90	70
2.45	29.5	2.95	38	3.45	52	3.95	72

The preceding table is based upon 4 discharge measurements made during 1904. It is well defined between gage heights 2.60 feet and 3.30 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Naches-Cowiche canal near North Yakima, Wash., for 1904.

[Irrigated area, 1,500 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			30.0	893	7.14
May	44	40	42.0	2,582	20.6
June	45	30	38.9	2,315	18.5
July	42	31	38.9	2,392	19.1
August	70	23	53.5	3,290	26.3
September	36	24	29.1	1,732	13.9
October 1–15 [b]	24	24	24.0	714	5.71
The period	70	23	38.4	13,920	111.2

[a] Estimated April 16 to May 5. [b] Estimated October 10–15.

BROADGAUGE CANAL NEAR NORTH YAKIMA, WASH.

This canal heads in a slough on the right bank of the river in sec. 10, T. 13 N., R. 18 E. About 3 miles below the intake it crosses the wasteway of the Power canal and draws from it the entire flow which it carries beyond this point The Broadgauge canal is now the property of the Northwestern Light and Water Company.

Discharge measurements of Broadgauge canal near North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 4 [a]	G. F. Harley	10	11.0	0.50	2.42	5.1
June 16 [a]	G. H. Bliss	10	9.5	.25	2.25	2.4
June 30 [b]	J. C. Dry	6	11.7	1.36	1.19	15.9
July 16 [b]	do	6	11.6	1.41	1.15	16.3
September 15 [b]	do	6	5.7	.89	.22	5.1

[a] Measured at headworks. [b] Measured below Power canal.

Mean daily gage height, in feet, of Broadgauge canal near North Yakima, Wash., for 1904.

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1		2.42	12		2.25	22	2.58	2.50
2		2.42	13		2.25	23	2.49	2.50
3		2.45	14		2.17	24	2.42	2.33
4		2.42	15		2.17	25	2.42	2.33
5		2.42	16		2.25	26	2.42	2.33
6		2.42	17	2.42	2.42	27	2.42	2.25
7		2.37	18	2.50	2.42	28	2.46	2.25
8		2.33	19	2.50	2.82	29	2.42	2.50
9		2.25	20	2.62	2.50	30	2.73	2.50
10		2.25	21	2.67	2.50	31	2.71	
11		2.25						

Mean daily discharge, in second-feet, of Broadgauge canal near North Yakima, Wash., for 1904.

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1		5.0	12		2.5	22	5.5	5.5
2		5.0	13		2.5	23	5.5	5.5
3		5.0	14		2.0	24	5 0	4.5
4		5.0	15		2.0	25	5.0	4.5
5		5.0	16		2.5	26	5.0	4.5
6		5.0	17	5.0	5.0	27	5.0	2.5
7		4.5	18	5.5	5.0	28	5.0	2.5
8		4.5	19	5.5	7.0	29	5.0	5.5
9		2.5	20	6.0	5.5	30	6.5	5.5
10		2.5	21	6.0	5.5	31	6.5	
11		2.5						

Estimated monthly discharge of Broadgauge canal near North Yakima, Wash., for 1904.

[Irrigated area, 500 acres.]

Month.	Discharge in second-feet.	Total in acre-feet.	Depth of run-off in inches, over irrigated area.
April 16–30	4.0	119	2.86
May	5.5	338	8.11
June [a]	17.0	1,012	24.3
July [b]	15.9	978	23.5
August [b]	16.3	1,002	24.0
September [b]	10.0	595	14.3
October 1–15 [b]	8.0	238	5.71
The period	11.8	4,282	102.8

[a] Partly from the Power canal.

[b] Taken from the Power canal.

POWER CANAL AT NORTH YAKIMA, WASH.

This canal heads in the river on its right bank in sec. 10, T. 13 N., R. 18 E. Previous to October, 1904, it was known as the Yakima Valley Light and Power Company canal. It is now the property of the Northwestern Light and Water Company, and is the largest canal taking water from Naches River. The new company now controls also the Shanno and Broadgauge canals. These two canals and the Union canal cross the Power canal, and during the summer are supplied chiefly by it. Only 250 acres are irrigated from the Power canal. It is used mainly for power purposes, and all of its flow not withdrawn by other canals is spilled into the Yakima River. The wastage is very regular in amount as shown by measurements of the wasteway.

Discharge measurements of Power canal at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
May 5 [a]	G. F. Harley	25	63	2.83	2.71	178
June 28 [a]	J. C. Dry	25	37	3.11	1.88	116
July 21 [b]	do	25	38	3.26	2.05	124
August 10 [b]	do	25	68	2.88	2.79	196
September 12 [b]	do	25	42	3.22	2.15	134
September 14 [b]	do	25	43	2.98	2.17	128

[a] Measured at the regulating gates.
[b] Measured on the wasteway near the Yakima River; average waste 125 second-feet.

Mean daily gage height, in feet, of Power canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.67	2.71	2.75	2.79	2.79
2	.....	2.71	2.71	2.75	2.75	2.79
3	.....	2.71	2.67	2.75	2.83	2.79
4	.....	2.75	2.67	2.75	2.83	2.79
5	2.71	2.75	2.71	2.75	2.83	2.79
6	2.71	2.58	2.67	2.75	2.87	2.79
7	2.79	2.58	2.71	2.75	2.79	2.83
8	2.83	2.71	2.67	2.71	2.83	2.83
9	2.71	2.67	2.62	2.67	2.79	2.75
10	2.67	2.67	2.71	2.75	2.79	2.75
11	2.71	2.67	2.67	2.75	2.79	2.87
12	2.67	2.67	2.67	2.62	2.79	2.83
13	2.67	2.71	2.62	2.79	2.79	.....
14	2.71	2.71	2.67	2.79	2.79	.....
15	2.67	2.75	2.71	2.79	2.83	.....
16	2.67	2.71	2.67	2.75	2.79	.....
17	2.67	2.67	2.67	2.75	2.79	.....
18	2.71	2.67	2.79	2.71	2.79	.....
19	2.71	2.71	2.75	2.75	2.75	.....

Mean daily gage height, in feet, of Power canal at North Yakima, Wash., for 1904—Cont'd.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
20	2.71	2.62	2.75	2.75	2.83	.....
21	2.67	2.75	2.75	2.75	2.79	.....
22	2.62	2.67	2.71	2.79	2.83	.....
23	2.50	2.67	2.79	2.75	2.79	.....
24	2.67	2.71	2.67	2.71	2.83	.....
25	2.67	2.75	2.71	2.75	2.79	.....
26	2.67	2.71	2.75	2.71	2.87	.....
27	2.67	2.71	2.67	2.75	2.87	.....
28	2.67	2.75	2.75	2.79	2.87	.....
29	2.62	2.75	2.75	2.79	2.87	.....
30	2.67	2.79	2.83	2.67	2.87	.....
31	2.71	.....	2.83	2.67	.....	.....

Mean daily discharge, in second-feet, of Power canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	172	178	187	196	196
2	.....	178	178	187	187	196
3	.....	178	172	187	198	196
4	.....	187	172	187	198	196
5	178	187	178	187	198	196
6	178	160	172	187	210	196
7	196	160	178	187	196	198
8	198	178	172	178	198	198
9	178	172	165	172	196	187
10	172	172	178	187	196	187
11	178	172	172	187	196	210
12	172	172	172	165	196	198
13	172	178	165	196	196	.....
14	178	178	172	196	196	.....
15	172	187	178	196	198	.....
16	172	178	172	187	196	.....
17	172	172	172	187	196	.....
18	178	172	196	178	196	.....
19	178	178	187	187	187	.....
20	178	172	187	187	198	.....
21	172	187	187	187	196	.....
22	165	172	178	196	198	.....
23	150	172	196	187	196	.....
24	172	178	172	178	198	.....
25	172	187	178	187	196	.....
26	172	178	187	178	210	.....
27	172	178	172	187	210	.....
28	172	187	187	196	210	.....
29	172	187	187	196	210	.....
30	172	196	198	172	210	.....
31	178	.....	198	172	.....	.....

Estimated monthly discharge of Power canal at North Yakima, Wash., for 1904.

[Irrigated area, 250 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 16–30 [a]			170	5,058
May	198	150	174	10,700
June	196	160	178	10,590
July	198	165	176	10,820
August	196	165	189	11,620
September	210	187	199	11,840
October 1–15 [b]	210	187	196	5,831
The period	210	150	183	66,460
Wasted into Yakima River			125	45,370
Used for irrigation and supplied to other canals			58	21,090

[a] Estimated April 15 to May 4. [b] Estimated October 13–15.

SHANNO CANAL AT NORTH YAKIMA, WASH.

This canal heads in Naches River on the right bank in sec. 11, T. 13 N., R. 18 E., in sec. 13. It crosses the Power canal and receives from it all the water carried beyond this point. The headworks of this canal were washed away during 1904, and in October, 1904, it became the property of the Northwestern Light and Water Company.

Discharge measurements of Shanno canal at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
May 5 [a]	G. F. Harley	9	13.0	1.77	1.19	23
June 16 [a]	G. H. Bliss	12	25.0	2.20	2.21	55
June 30 [a]	J. C. Dry	9	17.8	1.54	1.88	27
July 12 [b]	do	9	13.8	.74	.88	10
August 12 [b]	do	9	21.0	1.43	2.12	30
September 15 [b]	do	9	19.5	1.00	2.05	19

[a] Measured at the headworks. [b] Measured below the Power canal.

Mean daily gage height, in feet, of Shanno canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1	.....	.92	2.17	12	1.21	.92	.....	22	1.46	1.62	.....
2	.....	.87	1.96	13	1.25	.75	.....	23	1.46	1.00	.....
3	1.17	1.08	1.96	14	1.33	1.33	.....	24	1.50	(a)	.....
4	1.29	1.17	2.17	15	1.50	1.67	.....	25	1.25	.50	.....
5	1.25	1.50	2.17	16	1.46	2.17	.....	26	1.08	.50	.....
6	1.18	2.04	1.83	17	1.50	2.33	.....	27	.92	1.42	.....
7	1.17	1.67	1.62	18	1.25	2.83	.....	28	1.00	1.50	.....
8	1.17	.67	1.58	19	.92	2.62	.....	29	1.04	1.67	.....
9	1.08	.67	1.25	20	.92	2.04	.....	30	1.12	2.00	.....
10	1.12	.67	.83	21	1.04	1.67	.....	31	.83	.....	.....
11	1.12	(a)	.....								

[a] Water shut off.

Mean daily discharge, in second-feet, of Shanno canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Day.	May.	June.	July.	Day.	May.	June.	July.
1	.....	12	53	12	21	12	.....	22	30	36	.....
2	.....	10	46	13	23	8	.....	23	30	15	.....
3	20	18	46	14	24	25	.....	24	31	0	.....
4	24	20	53	15	31	33	.....	25	23	3	.....
5	22	31	53	16	30	54	.....	26	17	3	.....
6	20	48	42	17	31	59	.....	27	13	28	.....
7	20	36	34	18	23	75	.....	28	15	31	.....
8	20	6	34	19	12	69	.....	29	16	36	.....
9	17	6	23	20	12	49	.....	30	18	48	.....
10	18	6	10	21	16	37	.....	31	10	.....	.....
11	18	0	.....								

Rating table for Shanno canal at North Yakima, Wash., from May 3 to July 10, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.35	0.0	1.00	14.8	1.65	36.1	2.30	58.2
.40	1.0	1.05	16.4	1.70	37.8	2.35	59.9
.45	2.0	1.10	18.0	1.75	39.5	2.40	61.6
.50	3.0	1.15	19.6	1.80	41.2	2.45	63.3
.55	4.0	1.20	21.2	1.85	42.9	2.50	65.0
.60	5.0	1.25	22.9	1.90	44.6	2.55	66.7
.65	6.0	1.30	24.6	1.95	46.3	2.60	68.4
.70	7.0	1.35	26.2	2.00	48.0	2.65	70.1
.75	8.0	1.40	27.8	2.05	49.7	2.70	71.8
.80	9.0	1.45	29.5	2.10	51.4	2.75	72.5
.85	10.0	1.50	31.2	2.15	53.1	2.80	74.2
.90	11.6	1.55	32.8	2.20	54.8	2.85	75.9
.95	13.2	1.60	34.4	2.25	56.5		

The preceding table is based upon 3 discharge measurements made in 1904. It is well defined between gage heights 0.80 foot and 2.20 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Shanno canal at North Yakima, Wash., for 1904.

[Irrigated area, 1,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30 [a]			20.0	595	7.14
May	31	10	21.0	1,291	15.5
June [b]	75	2	29.1	1,616	19.4
July [c]	53	10	30.0	1,845	22.1
August			30.0	1,845	22.1
September			19.0	1,131	13.6
October 1–15			15.0	446	5.35
The period	75	2	24.4	8,769	105.2

[a] Estimated April 16 to May 2. [b] Water shut off two days. [c] After July 10 supplied by Power canal.

UNION CANAL AT NORTH YAKIMA, WASH.

This canal heads in Naches River in two places about one-half mile apart on the right bank in sec. 11, T. 13 N., R. 18 E. It is a very old canal, having first taken water from the Naches River in 1869. No appropriation was ever made for it, but the Union Canal Company agree to supply 3,000 miner's inches to its shareholders and 40 inches to private parties. The two branches unite about three-fourths mile below the upper headworks. In section 13 the Union canal crosses the wasteway of the Power canal and takes some additional water from it. From the Power canal to a point on Naches avenue, in sec. 18, T. 13 N., R. 19 E., a distance of about a mile, it is known as the Mill ditch. Here it leaves the Mill ditch, taking about half its flow, and continues south along Naches avenue. The water remaining in the Mill ditch is returned to the wasteway of the Power canal. The Union canal spills into Yakima River in sec. 32, T. 13 N., R. 19 E. Its waste here is about 1.5 per cent of the water taken in at the head-gates. The town of North Yakima uses water from this canal for the irrigation of shade trees.

Discharge measurements of Union canal at upper head works, at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 5	G. F. Harley	8	7.2	2.10	0.83	15.2
May 6	G. H. Bliss	8	8.0	2.04	.92	16.4
June 16	do	6	5.2	.72	.42	3.8
July 12	do	6	2.8	1.00	.33	2.8

Mean daily gage height, in feet, of Union canal at upper head works, at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	0.33	0.67	0.17	0.25	17	0.50	0.42	0.17	0.50	.....
2	.....	.33	.58	.17	.33	18	.50	.42	(a)	.42	.....
3	0.83	.33	.67	.33	.25	19	.42	.42	(a)	.42	.....
4	.92	.33	.71	.17	.17	20	.33	.37	(a)	.42	.....
5	1.00	.33	.50	.17	.08	21	.42	.42	.17	.37	.....
6	1.00	.33	.50	.17	.08	22	.25	.46	.50	.25	.....
7	(a)	.29	.46	.17	.08	23	.25	.42	.33	.25	.....
8	.50	.33	.42	.17	.12	24	.33	.37	.25	.17	.....
9	.50	.33	.33	.42	.08	25	.25	.37	(a)	.17	.....
10	.42	.33	.42	.33	.08	26	.33	.37	(a)	(a)	.....
11	.42	.50	.37	.17	.....	27	.42	.50	.33	.17	.....
12	1.25	.50	.25	.17	.....	28	.33	.50	.17	.25	.....
13	.50	.58	.25	.17	.....	29	.33	.50	.08	.58	.....
14	.50	.58	(a)	.12	.....	30	.42	.58	.17	.58	.....
15	.50	.58	(a)	.08	.....	31	.33	.....	.17	.37	.....
16	.50	.79	(a)	.50	.....						

a Water shut off.

Mean daily discharge, in second-feet, of Union canal at upper head works, at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	3	9	1	2	17	5	4	1	4	.....
2	.....	3	6	1	3	18	5	4	0	4	.....
3	15	3	9	3	2	19	4	4	0	4	.....
4	16	3	9	1	1	20	3	3	0	3	.....
5	22	3	5	1	.5	21	4	4	1	2	.....
6	22	3	5	1	.5	22	2	5	5	2	.....
7	0	2	4	1	.5	23	2	4	3	1	.....
8	5	3	4	1	1	24	3	3	2	1	.....
9	5	3	3	4	.5	25	2	3	0	0	.....
10	4	3	4	3	.5	26	3	3	0	1	.....
11	4	5	3	1	.....	27	1	5	3	2	.....
12	35	5	2	1	.....	28	3	5	1	7	.....
13	5	6	2	1	.....	29	3	5	.5	7	.....
14	5	6	0	1	.....	30	4	6	1	3	.....
15	5	6	0	0.5	.....	31	3	.....	1	.....	.....
16	5	14	0	5	.....						

Discharge measurements of Union canal at lower head works, at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec. feet.*
June 16 [a]	G. H. Bliss	13	17.6	2.27	1.92	40.0
July 12 [a]	do	13	19.0	1.71	1.70	32.5
August 12 [a]	J. C. Dry	13	20.4	1.89	2.04	38.5
June 28 [b]	do	10	23.0	1.84	2.02	42.4
July 16 [b]	do	10	23.4	1.70	1.92	39.4
September 14 [b]	do	10	21.1	1.63	1.80	34.5

[a] At the headworks. [b] Below the mill ditch.

Mean daily gage height, in feet, of Union canal at lower head works, at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	1.92	1.92	1.50	1.67	17	2.00	2.00	1.67	1.92	1.50
2	.....	1.83	1.92	1.58	1.67	18	1.83	2.08	1.67	1.83	1.50
3	.....	1.92	2.00	2.08	1.67	19	1.92	2.00	1.50	1.67	1.50
4	.....	1.92	2.00	2.00	1.50	20	1.92	1.96	2.33	1.67	1.50
5	.....	1.92	2.00	2.00	1.50	21	2.00	1.83	2.08	1.50	1.42
6	0.67	2.00	1.92	2.00	1.50	22	2.00	1.92	2.00	1.50	1.67
7	1.33	1.83	1.92	2.08	1.67	23	1.92	1.92	1.67	1.50	1.83
8	1.33	1.92	1.83	2.33	1.67	24	1.83	1.67	1.67	1.17	1.83
9	1.42	1.92	1.75	2.17	1.67	25	1.75	1.67	1.67	1.17	1.75
10	1.42	1.67	1.83	2.17	1.67	26	1.83	1.67	1.67	1.00	1.58
11	1.75	1.67	1.83	2.00	1.58	27	1.83	1.83	1.67	1.67	1.67
12	2.00	1.92	1.67	2.17	1.58	28	1.92	2.00	1.67	1.00	1.83
13	1.83	1.92	1.42	1.92	1.00	29	1.92	2.17	1.58	2.00	2.00
14	2.00	2.00	1.33	2.00	1.54	30	1.92	2.08	1.58	1.67	2.17
15	2.08	2.00	1.67	2.00	1.42	31	1.92	.....	1.50	1.83	.....
16	2.00	2.08	1.67	1.92	1.50						

Mean daily discharge, in second-feet, of Union canal at lower head works, at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	39	39	28	33	17	40	40	33	39	28
2	.....	35	39	28	33	18	35	41	33	35	28
3	.....	39	40	41	33	19	39	40	28	33	28
4	.....	39	40	40	28	20	39	40	47	33	28
5	.....	39	40	40	28	21	40	35	41	28	26
6	9	40	39	40	28	22	40	39	40	28	33
7	24	35	39	41	33	23	39	39	33	28	35
8	24	39	35	47	33	24	35	33	33	20	35
9	26	39	34	43	33	25	34	33	33	20	34
10	26	33	35	43	33	26	35	33	33	16	28
11	34	33	35	41	28	27	35	35	33	33	33
12	40	39	33	43	28	28	39	40	33	16	35
13	35	39	26	39	16	29	39	43	30	40	40
14	40	40	24	40	28	30	39	41	30	33	44
15	41	40	33	40	26	31	39	.....	28	35	.....
16	40	41	33	39	28						

Estimated monthly discharge[a] of Union canal at North Yakima, Wash., for 1904.

[Irrigated area, 2,000 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.	Depth of run-off, in inches, over irrigated area.
	Maximum.	Minimum.	Mean.		
April 16–30[b]			35.0	1,041	6.24
May	46	24	41.7	2,564	15.4
June	53	36	39.0	2,321	13.9
July	50	28	37.3	2,294	13.8
August	48	16	36.9	2,269	13.6
September	36	16	32.0	1,904	11.4
October 1–15[b]			30.0	893	5.35
The period	53	16	36.6	13,290	79.7

[a] Sum of discharge at the two intakes. [b] Estimated.

TOWN CANAL AT NORTH YAKIMA, WASH.

This canal heads in Naches River on the right bank one-eighth mile above the Northern Pacific Railway bridge and three-fourths mile above the mouth of the river. It is the property of the town of North Yakima and is used chiefly for the irrigation of shade trees. It irrigates also about 640 acres of land.

Discharge measurements of Town canal at North Yakima, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 5	G. H. Bliss	8	11.5	1.04	1.83	12,0
July 12	do	8	11.1	1.25	1.85	13.9

Mean daily gage height, in feet, of Town canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.79	2.04	1.92	2.00	2.08
2		1.79	1.96	2.08	2.00	2.00
3		1.75	2.00	1.92	1.92	1.92
4		1.75	2.04	1.83	1.92	1.75
5	1.83	1.92	1.96	2.00	1.87	1.58
6	1.75	2.00	1.92	2.50	1.83	1.50
7	1.67	1.75	1.83	2.33	1.83	1.42
8	1.71	1.58	1.87	2.50	1.75	1.33
9	1.67	1.37	1.71	2.42	1.75	1.25
0	1.62	1.92	1.75	2.37	1.83	
1	1.92	1.75	1.71	2.33	1.83	
2	1.92	1.79	1.67	2.33	1.83	
3	1.92	1.75	1.83	2.33	1.75	
4	2.33	1.83	1.92	2.21	1.75	

Mean daily gage height, in feet, of Town canal at North Yakima, Wash., for 1904—Cont'd.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
15	2.29	1.79	1.79	2.21	1.67	.....
16	2.33	1.96	1.75	2.17	1.62	.....
17	2.33	2.00	1.67	2.17	1.58	.....
18	2.37	2.25	1.50	2.17	1.58	.....
19	2.33	2.08	2.25	2.17	1.58	.....
20	2.29	2.00	2.33	2.12	1.62	.....
21	2.67	2.00	2.33	2.08	1.67	.....
22	2.67	1.96	2.08	2.04	1.75	.....
23	2.67	1.92	2.00	2.00	1.83	.....
24	2.54	1.92	2.00	2.00	1.75	.....
25	2.25	1.92	1.92	1.96	1.67	.....
26	1.92	1.83	1.92	1.87	1.58	.....
27	1.92	2.00	2.21	2.04	1.58	.....
28	1.83	1.87	2.00	2.25	1.67	.....
29	1.92	2.04	1.83	2.17	2.21	.....
30	1.92	2.00	1.67	2.17	2.17	.....
31	1.83	.....	1.50	2.08	.....	.....

Mean daily discharge, in second-feet, of Town canal at North Yakima, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	12	14	13	13	13
2	.....	12	13	14	13	13
3	.....	11	13	13	13	13
4	.....	11	14	12	13	11
5	12	13	13	13	13	9
6	11	13	13	17	12	9
7	10	11	12	16	12	9
8	11	10	13	17	11	8
9	10	8	11	17	11	8
10	10	13	11	16	12	.....
11	13	11	11	16	12	.....
12	13	12	10	16	12	.....
13	13	11	12	16	11	.....
14	16	12	13	15	11	.....
15	15	12	12	15	10	.....
16	16	13	11	15	10	.....
17	16	13	10	15	10	.....
18	16	15	9	15	10	.....
19	16	14	15	15	10	.....
20	15	13	16	14	10	.....
21	20	13	16	13	10	.....
22	20	13	14	13	11	.....
23	20	13	13	13	12	.....
24	20	13	13	13	11	.....
25	15	13	13	13	10	.....
26	13	12	13	12	10	.....
27	13	13	15	13	10	.....
28	12	13	13	15	10	.....
29	13	14	12	15	15	.....
30	13	13	10	15	15	.....
31	12	.....	9	15	.....	.....

Estimated monthly discharge of Town canal at North Yakima, Wash., for 1904.

[Irrigated area, 640 acres.]

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 16–30 [a]			10.0	298
May	20	10	14.0	861
June	15	8	12.3	732
July	16	9	12.5	769
August	17	12	14.5	892
September	15	10	11.4	678
October 1–15 [b]	13	8	10.0	298
The period	20	8	12.5	4,528

[a] Estimated April 16 to May 4. [b] Estimated October 10–15.

NORTHWESTERN LIGHT AND WATER COMPANY'S PROPOSED CANAL.

This company, upon October 3, 1904, filed upon 1,000 second-feet of water from Naches River, just below the mouth of Tieton River, on the left or north bank. It is a point in sec. 36, T. 15 N., R. 16 E., which is at the head works of the Wapatox canal.

The company proposes to construct a large canal, the flow of which will be used to generate power. The canal will be 9 miles long and will include the Wapatox canal throughout its length. At the end of the 9 miles all water except that required by the Wapatox canal, will be spilled back into the river at a point just above the intake of the Gleed canal.

CANALS TAKING WATER FROM YAKIMA, TIETON, AND NACHES RIVERS.

Canals taking water from Yakima River.

Canal.	Location.					Length in miles.
	Nearest town.	Head works.			Bank of river.	
		Section.	Township.	Range.		
Below Clealum River and above Naches River.						
Cascade	Thorp		19 N.	17 E.	Left	42½
West Kittitas	do	33	19 N.	17 E.	Right	14
Town	Ellensburg	7	18 N.	17 E.	Left	30
Olsen	do	18	18 N.	18 E.	do	
Selah-Moxee	North Yakima	8	14 N.	19 E.	do	27
Taylor	do				Right	4½
Below Naches River and above Atanum Creek.						
Moxee [a]	North Yakima	7	13 N.	19 E.	Left	8
Hubbard	do	7	13 N.	19 E.	do	7
Fowler	do	18	13 N.	19 E.	do	8½
Granger	do	18	13 N.	19 E.	do	

[a] Contract, 1 second-foot per 160 acres.

Canals taking water from Yakima River—Continued.

Canal.	Location.					Length in miles.
	Nearest town.	Head works.			Bank of river.	
		Section.	Township.	Range.		
Below Atanum Creek.						
New reservation No. 2	Yakima	17	12 N	19 E	Right	[a] 4½
Old reservation No. 1	do	28	12 N	19 E	do	12½
Government canal No. 3	Toppenish	28	11 N	20 E	do	4
Sunnyside [b]	Yakima	28	12 N	19 E	Left	38
Gilbert	Toppenish	19	11 N	20 E	Right	7
Hatch	do	30	10 N	21 E	do	3
Prosser Falls [c]	Prosser				do	10
Ledbetter	do				do	
Kiona [d]	Kiona	10	9 N	26 E	Left	9
Kiona Water Supply Co	do				do	
Kennewick [b]	Kennewick	3	10 N	27 E	Right	39½
Grosscup's	Kiona	3	10 N	27 E	Left	5½

Canal.	Appropriation.		Area under canal.		
	Amount in second-feet.	Date.	Irrigated.	Irrigable.[e]	Proposed extension.
Below Clealum River and above Naches River.			*Acres.*	*Acres.*	*Acres.*
Cascade	[f] 1,000 [g] 500	Nov. 19, 1903 Feb. 28, 1903		16,000	None.
West Kittitas	[h] 10,000	——, 1889	7,000	7,000	None.
Town	None.	[i] Apr. 25, 1889	8,000	10,000	None.
Olsen			1,200	1,200	None.
Selah-Moxee	150	Nov. 9, 1900	6,000	6,000	None.
Taylor	20	Mar. 24, 1888	1,000	1,400	None.
Below Naches River and above Atanum Creek.					
Moxee [b] Hubbard	150	Oct. 11, 1892	3,500	4,500	None.
Fowler	160	July 13, 1892	2,000	3,000	None.
Granger					
Below Atanum Creek.					
New reservation No. 2	1,000	Feb. 19, 1903	2,700	23,700	[j] 53,000
Old reservation No. 1	None.		8,000	17,000	None.
Government canal No. 3	None.			2,300	None.
Sunnyside [b]	1,000	Mar. 23, 1891	35,000	66,000	[j] 156,000
Gilbert	None.		3,000	4,000	None.
Hatch			600		None.
Prosser Falls [c]	(k)		1,200	2,200	None.
Ledbetter	1,000	July 22, 1892		360	None.
Kiona [d]	1,000	Aug. 28, 1889	1,800	800	[j] 26,000
Kiona Water Supply Co			150	150	None.
Kennewick [b]	300	Aug. 6, 1891	6,000	14,000	None.
Grosscup's	(l)	do		3,000	None.
Total			79,150	165,110	235,000

[a] Already constructed. Length as proposed, 65 miles.
[b] Contract, 1 second-foot per 160 acres.
[c] Power canal. Contract, old, 1 second-foot per 160 acres; new, 1 second-foot per 120 acres.
[d] Contract, 1 second-foot per 100 acres.
[e] "Acres irrigated" included in "Acres irrigable."
[f] From Lake Kachess.
[g] Yakima River.
[h] Miner's inches.
[i] Began using water.
[j] Additional.
[k] All river at this point.
[l] Uses same appropriation as Kennewick.

Canals taking water from Yakima River—Continued.

Canal.	Discharge in second-feet.								Total.
	Apr. 16–30.	May.	June.	July.	Aug.	Sept.	Oct. 1–15.	Average.	
Below Clealum River and above Naches River.									
Cascade	.....	.....	.....	.....	.....	.....	.....	[a]125	
West Kittitas	50	50	53	48.8	52.2	55	56	52	
Town	100	110	122	124	127	116	.....	116	
Olsen	.....	.....	.....	.....	.....	.....	.....	14	
Selah-Moxee	98	77.8	76.9	69.5	78.2	72.6	39	74.9	
Taylor	.....	.....	.....	.....	.....	.....	.....	11	393
Below Naches River and above Atanum Creek.									
Moxee [b]	17	18	18.3	10.3	35.4	30.7	4	21.1	
Hubbard	18	31	24.1	23.5	37.4	18.9	15	24.8	
Fowler	25	34	22	23.6	23	33	16	25.9	
Granger	.....	.....	.....	.....	.....	.....	.....	18	99
Below Atanum Creek.									
New reservation	20	27	49.1	86.4	69	73.6	50	56.4	
Old reservation	100	130	145	164	147	100	90	130	
Government canal No. 3	.....	.....	.....	.....	.....	.....	.....	10	
Sunnyside [b]	496	529	561	585	610	524	456	547	
Gilbert	25	40	58.9	47.9	28.6	17	10	35.1	
Hatch	.....	.....	.....	.....	.....	.....	.....	8	
Prosser Falls [c]	190	210	214	212	201	195	209	205	
Ledbetter	.....	.....	.....	.....	.....	.....	.....	2	
Kiona [d]	17	20	20	21.1	19	20.3	21.3	19.9	
Kiona Water Supply Co	.....	.....	.....	.....	.....	.....	.....	19	
Kennewick [b]	53.6	85.5	101	117	126	126	124	107	
Grosscup's	.....	.....	.....	.....	.....	.....	.....	.....	1,139
Total	.....	.....	.....	.....	.....	.....	.....	.....	1,622

Canals taking water from Tieton and Naches rivers.

Canal.	Location.					Length in miles.
	Nearest town.	Head works.			Bank of river.	
		Section.	Township.	Range.		
From Tieton River.						
Sinclair and Cobb	North Yakima	10	14 N	16 E	Left	
From Naches above Tieton River.						
Selah Valley [e]	North Yakima	35	15 N	16 E	Left	20
Small ditches (combined)						
From Naches below Tieton and above Cowiche Creek.						
Wapatox	North Yakima	36	15 N	16 E	Left	16
Cox	do	6	14 N	17 E	Right	
Upper Scott	do	4	14 N	17 E	do	
Lower Scott	do	9	14 N	17 E	do	
Fortune	do	9	14 N	17 E	do	

[a] Estimated capacity of canal.
[b] Contract, 1 second-foot per 160 acres.
[c] Power canal. Contract, old, 1 second-foot per 160 acres; new, 1 second-foot per 120 acres.
[d] Contract, 1 second-foot per 100 acres.
[e] Contract: Old, 1 second-foot to 160 acres; new, 1 second-foot to 100 acres.

Canals taking water from Tieton and Naches rivers—Continued.

Canal.	Location.					Length in miles.
	Nearest town.	Head works.			Band of river.	
		Section.	Township.	Range.		
From Naches below Tieton and above Cowiche Creek—Continued.						
Laswell	North Yakima	14	14 N	17 E	Right	
Yakima Valley	do	24	14 N	17 E	do	22
Rhodenbach-Schuler	do	6	13 N	18 E	do	
Clark	do		14 N	17 E	Left	
Lowry	do		14 N	17 E	do	
Kelly	do		14 N	17 E	do	
Gleed	do	24	14 N	17 E	do	6
Morrisey	do	25	14 N	17 E	do	
White and Leach	do	(a)			do	
McCormick	do	(a)			do	
Shearer-Chapman	do	(b)			do	
Naches-Cowiche	do	9	13 N	18 E	Right	7
From Naches below Cowiche Creek.						
Broadgauge [c]	North Yakima	10	13 N	18 E	Right	3
Power [c]	do	10	13 N	18 E	do	6
Shanno [c]	do	11	13 N	18 E	do	8
Union	do	11	13 N	18 E	do	8½
Town	do	12	13 N	18 E	do	

Canal.	Appropriation.		Area under canal—		Proposed extension.
	Amount in second-feet.	Date.	Irrigated.	Irrigable.	
From Tieton River.			*Acres.*	*Acres.*	*Acres.*
Sinclair and Cobb			320	320	None.
From Naches above Tieton River.					
Selah Valley	800	Nov. 13, 1888	6,000	9,500	d e 5,000
Small ditches (combined)					None.
From Naches below Tieton and above Cowiche Creek.					
Wapatox	30	Apr. 13, 1888	1,400	2,000	d 3,000
Cox			60	210	None.
Upper Scott			200	600	None.
Lower Scott			150	400	None.
Fortune	1,000	Apr. 23, 1892	200	400	None.
Laswell	f 5,000		275	650	None.
Yakima Valley	150	Mar. 22, 1894	3,600	4,200	None.
Rhodenbach-Schuler	5	1882–1892	300	300	None.
Clark	f 1,500	Mar. 6, 1889	400	450	None.
Lowry	f 2,000	——, 1884	300	400	None.
Kelly			500	600	None.
Gleed	100	Apr. 1, 1889	1,400	1,400	None.
Morrisey	f 300	Nov. 13, 1894	300	400	None.
White and Leach			200	300	None.
McCormick			200	200	None.
Shearer-Chapman			400	400	None.
Naches-Cowiche	100	Feb. 9, 1895	1,500	1,500	None.

[a] About 2 miles below Gleed canal.
[b] About 4 miles below Gleed canal.
[c] Property of the Northwestern Light and Power Company.
[d] Additional.
[e] Pipe line extensions.
[f] Miner's inches.

Canals taking water from Tieton and Naches rivers—Continued.

Canal.	Appropriation.		Area under canal—		Proposed extension.
	Amount in second-feet.	Date.	Irrigated.	Irrigable.	
From Naches below Cowiche Creek.			*Acres.*	*Acres.*	*Acres.*
Broadgauge	16	——, 1885	500	800	None.
Power	450 400	Oct. 1, 1889 Jan. 8, 1902	250	250	None.
Shanno	60	——, 1870	1,000	1,600	None.
Union	(a)	None.[b]	2,000	3,000	None.
Town	.....	.....	640	640	.....
Total	.....	.....	22,090	30,520	.....

Canal.	Discharge in second-feet.								
	Apr. 16–30.	May.	June.	July.	Aug.	Sept.	Oct. 1–15.	Average.	Total.
From Tieton River.									
Sinclair and Cobb	.....	.....	.....	.....	.....	.....	.....	5	5
From Naches above Tieton River.									
Selah Valley	45	59	83.3	69.5	86.7	80.8	60.0	72.0	.....
Small ditches (combined)	.....	.....	.....	.....	.....	.....	.....	15	87
From Naches below Tieton and above Cowiche Creek.									
Wapatox	20.0	40.0	37.2	29.0	37.0	26.1	14.8	31.2	.....
Cox	.....	.....	.....	.....	.....	.....	.....	4	.....
Upper Scott	.....	.....	.....	.....	.....	.....	.....	7	.....
Lower Scott	.....	.....	.....	.....	.....	.....	.....	10	.....
Fortune	.....	.....	.....	.....	.....	.....	.....	7	.....
Laswell	.....	.....	.....	.....	.....	.....	.....	10	.....
Yakima Valley	40.0	46.8	55.3	62.5	77.5	60.8	43.4	57.4	.....
Rhodenbach-Schuler	.....	.....	.....	.....	.....	.....	.....	6	.....
Clark	.....	.....	.....	.....	.....	.....	.....	5	.....
Lowry	.....	.....	.....	.....	.....	.....	.....	15	.....
Kelly	.....	.....	.....	.....	.....	.....	.....	[c] 30	.....
Gleed	40	65	61.1	55.9	69.4	38.8	28.0	54.2	.....
Morrisey	.....	.....	.....	.....	.....	.....	.....	[c] 6	.....
White and Leach	.....	.....	.....	.....	.....	.....	.....	[c] 8	.....
McCormick	.....	.....	.....	.....	.....	.....	.....	[c] 5	.....
Shearer-Chapman	.....	.....	.....	.....	.....	.....	.....	6	.....
Naches-Cowiche	30.0	42.0	38.9	38.9	53.5	29.1	24.0	38.4	300
From Naches below Cowiche Creek.									
Broadgauge	4.0	5.5	[d] 17.0	[d] 15.9	[d] 16.3	[d] 10.0	[d] 8.0	[d] 11.8	.....
Power	170	174	178	176	189	199	196	183	.....
Shanno	20.0	21	29.1	[d] 30	[d] 30	[d] 19	[d] 15	[d] 24.4	.....
Union	35	41.7	39	37.3	36.9	32.0	30.0	36.6	.....
Town	10	14	12.3	12.5	14.5	11.4	10.0	12.5	[c] 268
Total	.....	.....	.....	.....	.....	.....	.....	.....	[e] 660

[a] Agrees to deliver 3,000 inches.
[b] First used water, 1869.
[c] Partly seepage water from canals above.
[d] From Power canal.
[e] Forty second-feet estimated amount included in discharge of other canals drawing from Power canal.

SNAKE RIVER (NORTH FORK) NEAR ORA, IDAHO.

This station was established August 20, 1902, by N. S. Dils, and a temporary gage was set. It is located at the North Fork Bridge, 2 miles south of Ora and 10 miles above St. Anthony, Idaho. A permanent vertical gage was set on October 6, 1904, by William G. Davies. The zero of this permanent gage is at the same elevation as the zero of the temporary gage. This gage consists of a 2 by 12 inch plank securely spiked to the first bridge pier from north abutment. This plank is beveled on one edge. The gage is graduated to feet and half tenths painted white, and marked with United States Geological Survey name plate. The observer is Mrs. Martha J. Fritz. The initial point for soundings is a bolt through the toe of the end brace on the lower side of the north end of the bridge. The bridge is 210 feet long. It consists of four spans resting on three rock-filled crib piers. Measurements are made from the lower side of this bridge. The channel is straight both above and below this station. The banks are high and do not overflow. The bed of the stream is hard gravel, quite smooth, and not liable to change. The current is swift. Bench mark No. 1 is a United States Geological Survey aluminum tablet set in a large rock about 30 feet northeast from north end of bridge. Its elevation is 12.84 above zero of gage. Bench mark No. 2 is a cross on a large flat rock marked "B. M." 25 feet northeast from north end of bridge. Its elevation is 11.10 feet above zero of gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Snake River (Nork Fork) near Ora, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 12	F. S. Stockton	177	361	3.31	2.1	1,194
May 3	do	177	593	5.37	3.3	3,183
May 17	Wm. G Davies	178	717	6.45	4.1	4,623
July 11	do	177	423	3.60	2.4	1,523

Mean daily gage height, in feet, of Snake River (North Fork) near Ora, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	2.0	2.0	1.9	3.0	3.3	2.5	2.3	2.2	2.2	2.2	2.1
2	2.0	2.0	2.0	1.9	3.3	3.3	2.5	2.3	2.2	2.2	2.2	2.1
3	2.0	2.0	2.0	1.9	3.3	3.5	2.5	2.3	2.2	2.2	2.2	2.1
4	2.0	2.0	2.0	2.0	3.7	3.3	2.5	2.2	2.2	2.2	2.2	2.1
5	2.0	2.0	2.0	2.0	3.8	3.2	2.5	2.2	2.2	2.2	2.2	2.1
6	2.0	2.0	2.0	2.0	4.2	3.2	2.6	2.2	2.2	2.2	2.2	2.1
7	2.0	2.0	2.0	2.0	4.1	3.1	2.6	2.2	2.2	2.2	2.2	2.1
8	2.0	2.0	2.0	2.0	4.0	3.1	2.4	2.2	2.2	2.2	2.2	2.1
9	2.0	2.0	2.0	2.0	4.1	3.1	2.4	2.2	2.2	2.2	2.2	2.1
10	2.0	2.0	2.0	2.0	4.2	3.1	2.4	2.2	2.2	2.2	2.2	2.1
11	2.0	2.0	2.0	2.0	4.0	3.0	2.4	2.2	2.2	2.2	2.2	2.1
12	2.0	2.0	2.0	2.1	4.0	3.0	2.4	2.2	2.2	2.2	2.2	2.1
13	2.0	2.0	2.0	2.2	4.0	3.0	2.4	2.2	2.2	2.2	2.2	2.1
14	2.0	2.0	2.0	2.3	4.1	3.0	2.4	2.2	2.2	2.2	2.2	2.1
15	2.0	2.0	2.0	2.4	4.2	2.9	2.4	2.2	2.2	2.2	2.2	2.1
16	2.0	2.0	2.0	2.4	4.1	2.9	2.4	2.2	2.2	2.3	2.2	2.1
17	2.0	2.0	1.9	2.3	4.1	2.8	2.3	2.2	2.2	2.3	2.2	2.1
18	2.0	2.0	1.9	2.3	4.1	2.8	2.3	2.1	2.2	2.3	2.2	2.1
19	2.0	2.0	1.9	2.4	4.2	2.8	2.3	2.1	2.2	2.2	2.2	2.1
20	2.0	2.0	1.9	2.5	4.5	2.8	2.3	2.1	2.2	2.2	2.2	2.1
21	2.0	2.0	1.9	2.5	4.3	2.7	2.3	2.1	2.2	2.2	2.1	2.1
22	2.0	2.0	1.9	2.4	4.2	2.7	2.3	2.1	2.2	2.2	2.1	2.1
23	2.0	2.0	1.9	2.3	4.2	2.7	2.3	2.1	2.2	2.2	2.1	2.1
24	2.0	2.0	2.0	2.3	4.0	2.6	2.3	2.2	2.2	2.2	2.1	2.1
25	2.0	2.0	2.0	2.3	3.8	2.6	2.3	2.2	2.2	2.2	2.1	2.1
26	2.0	2.0	2.0	2.4	3.5	2.6	2.3	2.2	2.2	2.2	2.1	2.1
27	2.0	2.0	1.9	2.5	3.4	2.6	2.3	2.2	2.2	2.2	2.1	2.1
28	2.0	2.0	1.9	3.0	3.3	2.6	2.3	2.2	2.2	2.2	2.1	2.1
29	2.0	2.0	1.9	2.9	3.2	2.5	2.3	2.2	2.2	2.2	2.1	2.1
30	2.0	.....	1.9	2.9	3.3	2.5	2.3	2.2	2.2	2.2	2.1	2.1
31	2.0	.....	1.9	.....	3.3	.....	2.3	2.2	.....	2.2	.....	2.2

Rating table for Snake River (North Fork) near Ora, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.90	1,020	2.60	1,900	3.30	3,160	4.00	4,420
2.00	1,110	2.70	2,080	3.40	3,340	4.10	4,610
2.10	1,205	2.80	2,260	3.50	3,520	4.20	4,800
2.20	1,310	2.90	2,440	3.60	3,700	4.30	4,990
2.30	1,425	3.00	2,620	3.70	3,880	4.40	5,180
2.40	1,555	3.10	2,800	3.80	4,060	4.50	5,370
2.50	1,720	3.20	2,980	3.90	4,240		

The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1902 to 1904, inclusive. It is well defined between gage heights 2.00 feet and 4.10 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Snake River (North Fork) near Ora, Idaho, for 1904.

[Drainage area, 1,040 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	1,110	1,110	1,110	68,250	1.07	1.23
February	1,110	1,110	1,110	63,850	1.07	1.15
March	1,110	1,020	1,075	66,100	1.03	1.19
April	2,620	1,020	1,448	86,170	1.39	1.55
May	5,370	2,620	4,167	256,200	4.01	4.62
June	3,520	1,720	2,458	146,300	2.36	2.63
July	1,900	1,425	1,541	94,750	1.48	1.71
August	1,425	1,205	1,301	80,000	1.25	1.44
September	1,310	1,310	1,310	77,950	1.26	1.41
October	1,425	1,310	1,321	81,220	1.27	1.46
November	1,310	1,205	1,275	75,870	1.23	1.37
December	1,310	1,205	1,208	74,280	1.16	1.34
The year	5,370	1,020	1,610	1,171,000	1.55	21.10

SNAKE RIVER NEAR MINIDOKA, IDAHO.

Ten miles above the gaging station at Montgomery's ferry occurs a natural dam site, from which, as a starting point, surveys for canal lines have been run, covering the large extent of rolling country susceptible of irrigation on both sides of the river. Measurements at Montgomery's ferry show the amount of water available for irrigation purposes there, and for the newly constructed Twin Falls canals heading 23 miles below, and also the conditions that will exist for power purposes at Shoshone Falls, about 45 miles below, after the irrigable lands of Snake River Valley shall have been reclaimed.

This station was originally established August 5, 1895, at Montgomery's ferry on the stage road from Minidoka to Albion, Idaho.

When the station was visited on October 14, 1899, a comparison was made of the gage rod with the bench mark, and it was found that the rod had moved to a considerable extent, due to the action of the quicksand on the inclined portion of the rod. The heights as recorded by the observer, as well as the discharge measurements, were corrected. Gage readings were not taken during 1900.

The station was reestablished May 1, 1901, and the gage read morning and evening for the remainder of the year. Part of the inclined gage rod which had been moved by quicksand was corrected August 9, 1901, and all previous gage readings were carefully adjusted to correspond with the present position of the rod.

On October 16, 1903, the gage was carefully checked by means of a level. Different sections of the gage were found to be from 0.1 to 0.3 foot too high. The gage was corrected and the gage heights adjusted to conform with the old gage datum. The lower section of the gage is an inclined 4 by 4 inch timber and reads from zero to 6.8 feet. The upper section is vertical and reads from 6.8 to 13 feet. The gage is read twice each day by George Montgomery, the ferryman. Discharge measurements are made from the ferryboat. A tagged wire has been stretched above the ferry cable. The initial point for soundings is the cable support on the right bank. The channel is straight for 300 feet above and below the station and has a width at the ferry of about 800 feet. Both banks are high, without vegetation, and are not liable to overflow. There is but one channel at all stages. The bench mark, established when the original gage was installed, is a spike in the east post of the tool house on the right bank. The spike is 1.2 feet above the ground, 52 feet west of the gage, and has an elevation of 17.50 feet above the zero of the gage. The letters "B. M." are marked in black paint on the post.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Snake River near Minidoka, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 9	F. Stockton	804	3,709	1.48	2.90	5,494
May 5	do	840	6,816	2.73	6.40	18,590
May 12	Wm. G. Davies	865	7,524	2.70	7.05	20,190
June 10	do	881	9,556	3.43	9.30	29,860
July 7	J. B. Bond	782	6,476	2.51	6.70	16,400
August 2	do	817	4,255	1.51	3.50	6,794
August 13	do	798	3,215	1.37	2.20	4,331
September 22	Wm. G. Davies	800	3,592	1.29	2.68	4,655
October 30	do	810	4,034	1.26	3.21	5,521

Mean daily gage height, in feet, of Snake River near Minidoka, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.0	3.0	3.4	3.1	6.0	10.1	6.8	3.55	2.95	2.8	3.2	3.1
2	5.0	3.1	3.5	3.1	6.1	10.1	6.65	3.45	3.15	2.8	3.2	3.2
3	4.9	2.85	3.55	3.0	6.1	10.1	6.7	3.35	3.3	2.8	3.2	3.2
4	4.85	2.65	3.4	3.0	6.2	10.1	6.75	3.15	3.3	2.8	3.2	3.1
5	4.75	2.6	3.4	3.0	6.4	10.2	6.7	3.05	3.3	2.8	3.2	3.1
6	4.6	2.6	3.3	3.0	6.6	10.05	6.8	2.85	3.15	2.8	3.2	3.0
7	4.45	2.6	3.3	3.0	7.0	9.8	6.65	2.65	3.1	2.8	3.2	3.0
8	4.3	2.6	3.4	3.0	7.1	9.4	6.55	2.55	3.1	2.9	3.2	3.0
9	4.15	2.75	3.55	2.95	7.3	9.3	6.35	2.45	3.1	2.9	3.2	3.0

Mean daily gage height, in feet, of Snake River near Minidoka, Idaho, for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
10	4.0	3.2	3.6	2.9	7.25	9.3	6.2	2.35	3.1	3.0	3.2	3.0
11	3.9	a3.9	3.6	2.9	7.15	9.3	6.1	2.25	3.0	3.0	3.2	3.0
12	3.8	a4.7	3.7	2.9	7.1	9.1	6.1	2.2	2.9	3.0	3.2	3.1
13	3.7	a4.45	3.6	2.9	7.4	9.2	6.0	2.1	2.9	3.0	3.2	3.1
14	3.6	a3.8	3.5	3.0	7.6	9.1	5.9	2.1	2.8	3.0	3.2	3.2
15	3.65	3.35	3.4	3.15	7.7	8.9	5.9	2.1	2.8	3.0	3.2	3.2
16	3.8	3.15	3.3	3.35	7.8	8.55	5.8	2.1	2.8	3.0	3.2	3.2
17	3.9	3.0	3.3	3.6	8.0	8.4	5.7	2.1	2.8	3.05	3.1	3.2
18	4.0	2.9	3.3	4.0	8.1	8.65	5.55	2.1	2.8	3.1	3.1	3.1
19	4.2	2.75	3.2	4.35	8.3	8.75	5.35	2.1	2.8	3.1	3.1	3.0
20	4.2	2.55	3.2	4.4	8.3	8.8	5.15	2.2	2.8	3.1	3.1	2.9
21	4.05	2.7	3.3	4.5	8.5	8.6	4.95	2.35	2.7	3.1	3.1	2.9
22	3.95	3.45	3.4	4.9	8.9	8.6	4.75	2.3	2.7	3.1	3.1	2.9
23	3.75	3.3	3.4	5.3	9.3	8.6	4.55	2.3	2.7	3.1	3.1	2.9
24	3.65	3.35	3.4	5.3	9.65	8.6	4.35	2.4	2.7	3.1	3.1	2.9
25	3.55	3.25	3.4	5.1	9.9	8.5	4.2	2.45	2.7	3.1	3.1	2.95
26	3.5	3.15	3.3	4.95	10.2	8.4	4.15	2.5	2.7	3.1	3.1	a3.45
27	3.4	3.1	3.3	4.75	10.6	8.2	4.05	2.5	2.7	3.2	3.2	a3.85
28	3.3	3.2	3.25	4.8	11.0	7.65	3.95	2.6	2.7	3.2	3.2	a4.25
29	3.2	3.3	3.2	5.05	10.8	7.25	3.85	2.7	2.8	3.2	3.2	a4.6
30	3.1	.....	3.2	5.55	10.45	7.05	3.7	2.7	2.8	3.2	3.2	a4.85
31	3.1	.....	3.15	.....	10.2	.....	3.65	2.75	.....	3.2	.....	a4.7

a Ice.

Rating table for Snake River near Minidoka, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.00	3,930	3.50	6,790	5.00	10,720	7.00	19,000
2.10	4,100	3.60	7,010	5.10	11,060	7.20	19,920
2.20	4,275	3.70	7,240	5.20	11,410	7.40	20,840
2.30	4,450	3.80	7,470	5.30	11,780	7.60	21,760
2.40	4,630	3.90	7,710	5.40	12,160	7.80	22,680
2.50	4,810	4.00	7,950	5.50	12,560	8.00	23,600
2.60	4,995	4.10	8,190	5.60	12,960	8.20	24,560
2.70	5,180	4.20	8,440	5.70	13,360	8.40	25,520
2.80	5,370	4.30	8,690	5.80	13,760	8.60	26,480
2.90	5,560	4.40	8,950	5.90	14,180	8.80	27,440
3.00	5,750	4.50	9,220	6.00	14,600	9.00	28,400
3.10	5,950	4.60	9,490	6.20	15,460	9.50	30,800
3.20	6,150	4.70	9,770	6.40	16,340	10.00	33,200
3.30	6,360	4.80	10,070	6.60	17,220	10.50	35,600
3.40	6,570	4.90	10,390	6.80	18,100	11.00	38,000

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1895 to 1904, inclusive. It is well defined. Above gage height 8.00 feet the rating curve is a tangent, the difference being 480 per tenth.

Estimated monthly discharge of Snake River near Minidoka, Idaho, for 1904.

[Drainage area, 22,600 square miles.]

Month.	Discharge in second-feet.			Run-off.		
	Maximum.	Minimum.	Mean.	Total in acre-feet.	Second-feet per square mile.	Depth in inches.
January [a]			6,050	372,000	0.338	0.390
February			5,783	332,600	.323	.348
March	7,240	6,050	6,534	401,800	.365	.421
April	12,760	5,560	7,790	463,500	.435	.485
May	38,000	14,600	24,520	1,508,000	1.37	1.58
June	34,160	19,230	28,200	1,678,000	1.58	1.76
July	18,100	7,125	12,970	797,500	.725	.836
August	6,900	4,100	4,881	300,100	.273	.315
September	6,360	5,180	5,576	331,800	.311	.347
October	6,150	5,370	5,778	355,300	.323	.372
November	6,150	5,950	6,083	362,000	.340	.379
December			5,832	358,600	.326	.376
The year			10,000	7,261,000	.559	7.61

[a] Discharge estimated January 1–31–February 11–14–December 26–31 on account of ice gorging.

FALL RIVER AT FREMONT, IDAHO.

This station supersedes the station at Wilson's Mill, near Marysville, which was discontinued December 31, 1903, because of the difficulty of securing an observer. It was established January 1, 1904, when a temporary gage was placed at Fremont, 3 miles below Wilson's Mill, and readings were made from this gage until October 28, when a cable, car, and permanent gage were installed. The gage consists of a 4 by 4 inch timber graduated to feet and tenths, fastened in a vertical position by anchor bolts and vertical braces. It is painted white and marked with United States Geological Survey name plate. The gage is on the south bank of the stream, about 900 feet from Fremont post-office. The zero of this gage is at the same elevation as the zero of the temporary gage. The observer is Mrs. Eva A. Loomis. P. Wilson has been observer of the Wilson's Mill gage during high water. The initial point for soundings is a tin tag marked "I. P." on the inside face of the cable on the south bank of the stream. The cable is about 500 feet below the gage. The channel is straight above and below the station. Both banks are high, wooded, steep, and are not liable to overflow. There is but one channel at all stages. The bench mark is a standard aluminum tablet set in a rock 20 feet from the gage. Its elevation is 10.36 feet above the zero of the gage.

The Brady canal, capacity about 100 second-feet, heads in the right bank of the river between Wilson's Mill and the Fremont station.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district hydrographer.

Discharge measurements of Fall River at Fremont, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 19	W. G. Davies	115	640	6.59	[a] 5.20	4,235
June 28	do	114	451	4.62	[a] 3.55	2,096
August 1	J. G. Bond	112	300	3.51	[a] 2.40	1,140
August 14	W. G. Davies	110	246	3.04	[a] 2.28	[b] 739
October 28	do	140	209	2.37	[c] 2.10	496

[a] Gaged at Wilson's Mill.
[b] Gage at Fremont station 2.25. Discharge of Brady canal 85 second-feet. Discharge at Fremont station 654 second-feet.
[c] Gaged at Fremont.

Mean daily gage height, in feet, of Fall River at Fremont, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	1.8	1.9	1.9	.....	3.8	3.2	2.4	2.25	2.15	2.1	2.0
2	2.0	1.8	1.9	1.9	.....	3.8	3.2	.....	2.25	2.1	2.1	2.0
3	2.0	1.8	1.9	1.9	.....	3.8	.....	.....	2.2	2.1	2.1	2.0
4	2.0	1.8	1.9	1.9	.....	3.8	3.2	2.3	2.2	2.15	2.05	2.0
5	2.0	1.8	1.9	1.9	.....	3.7	.....	.....	2.2	2.15	2.05	2.0
6	2.0	1.8	1.9	1.9	.....	.....	3.2	2.3	2.18	2.18	2.05	2.0
7	2.0	1.8	2.0	1.9	.....	3.7	.....	.....	2.18	2.2	2.05	2.0
8	2.0	1.8	2.0	1.9	.....	.....	3.2	2.2	2.18	2.2	2.05	2.0
9	2.0	1.8	2.0	1.9	.....	3.7	.....	.....	2.18	2.2	2.05	2.0
10	2.0	1.8	2.0	1.9	.....	.....	3.1	.....	2.18	2.2	2.05	2.0
11	1.9	1.8	2.0	2.0	.....	3.7	.....	.....	2.18	2.2	2.05	2.05
12	1.9	1.8	1.9	2.1	.....	3.6	3.0	.....	2.18	2.15	2.05	2.05
13	1.9	1.8	1.9	2.25	.....	3.6	.....	.....	2.18	2.15	2.05	2.05
14	1.9	1.8	1.9	2.25	.....	3.6	3.0	2.25	2.18	2.1	2.05	2.05
15	1.9	1.8	1.9	2.5	.....	3.6	.....	2.25	2.18	2.1	2.05	2.05
16	1.9	1.8	1.9	2.35	.....	3.6	3.0	2.25	2.18	2.1	2.05	2.05
17	1.9	1.8	1.9	2.3	.....	3.6	.....	2.28	2.18	2.1	2.05	2.05
18	1.9	1.8	1.9	2.3	.....	3.6	3.0	2.28	2.18	2.1	2.05	2.05
19	1.8	1.8	1.9	2.4	.....	3.6	.....	2.28	2.18	2.1	2.05	2.0
20	1.8	1.8	1.9	2.45	.....	3.6	3.0	2.28	2.18	2.1	2.05	2.0
21	1.8	1.8	1.9	2.4	.....	3.6	.....	2.25	2.18	2.1	2.05	2.0
22	1.8	1.8	1.9	2.35	.....	3.6	2.8	2.25	2.15	2.1	2.05	2.0
23	1.8	1.8	1.9	2.3	.....	3.6	.....	2.25	2.18	2.1	2.0	2.0
24	1.8	1.8	1.9	.....	.....	3.6	2.8	2.28	2.18	2.1	2.0	2.0
25	1.8	1.8	1.9	.....	.....	3.6	.....	2.3	2.15	2.1	2.0	2.0
26	1.8	1.8	1.9	.....	.....	3.6	2.7	2.35	2.15	2.1	2.0	2.0
27	1.8	1.8	1.9	.....	.....	3.6	2.6	2.35	2.15	2.1	2.0	2.0
28	1.8	1.9	1.9	.....	.....	3.6	.....	2.35	2.15	2.1	2.0	2.0
29	1.8	1.9	1.9	.....	.....	3.5	.....	2.3	2.15	2.1	2.0	2.0
30	1.8	.....	1.9	.....	.....	3.5	2.5	2.3	2.15	2.1	2.0	2.0
31	1.8	.....	1.9	.....	.....	.....	.....	2.28	.....	2.1	.....	2.0

NOTE. Gage heights from June 1 to August 8 are based on gage heights at Wilson Mill gage and also on simultaneous readings. Gage heights from October 16 to 22 are interpolated.

TETON RIVER NEAR ST. ANTHONY, IDAHO.

This station was established April 23, 1903, by N. S. Dils. It is located at the bridge on the stage road from St. Anthony to Victor, Idaho. The gage is a vertical 2 by 12 inch timber 8 feet long, spiked to the upstream side of the right crib abutment. A permanent gage was set October 5, 1904. This gage consists of 2 by 12 inch fir timber set vertical and spiked to the upstream side of the north end abutment. The gage is graduated to half tenths of a foot; the graduations being marked by metallic numerals and staples. The gage is painted white, and marked with a United States Geological Survey name plate. The zero of this gage is same elevation as zero of old gage. It is read once each day by William Ferguson. Discharge measurements are made from the two-span bridge to which the gage is attached. The bridge is supported by crib abutments, constructed of logs, filled with lava rock and by a similar middle pier. The initial point from which soundings are made is a large bolt marked "I. P." in the upstream side of the south end abutment. The channel is straight for a short distance above and below the station. The right bank is high, and will not overflow. The left bank will overflow at extreme flood stages. The current is sluggish. Both banks and bed are composed of hard gravel, and the latter is permanent. Bench mark No. 1 is a United States Geological Survey aluminum tablet set in solid rock about 30 feet northeast of north end of bridge. Its elevation is 13.53 feet above the zero of the gage. Bench mark No. 2 is a cross on a large flat rock 40 feet northeast of the right end of the bridge. It is marked "B. M." and has an elevation of 14.25 feet above the zero of the gage. Bench mark No. 3 is a similar rock 60 feet northwest of the right end of the bridge. It is similarly marked, and has an elevation of 14.41 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Teton River near St. Anthony, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 11	F. Stockton	78	376	2.29	2.30	862
May 3	Stockton and Murphy	78	394	2.78	2.60	1,077
June 22	Wm. G. Davies	78	522	4.95	4.10	2,582
July 25	do	78	384	2.40	2.45	921
October 5	do	65	310	1.65	1.70	512

Mean daily gage height, in feet, of Teton River near St. Anthony, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	2.70	.....	.....	2.30	4.10	3.30	2.20	1.90	1.70	1.60	1.50
2	3.10	2.70	.....	.....	2.50	4.10	3.30	2.20	1.90	1.70	1.60	1.50
3	3.00	2.70	.....	.....	2.60	4.10	3.30	2.20	1.90	1.70	1.60	1.50
4	2.90	2.70	.....	.....	2.80	3.80	3.20	2.10	1.90	1.70	1.60	1.50
5	2.90	2.70	.....	.....	3.00	3.50	3.10	2.10	1.80	1.70	1.60	1.60
6	2.90	2.70	.....	.....	3.00	3.40	3.00	2.10	1.80	1.70	1.60	1.65
7	2.90	2.70	.....	.....	2.90	3.40	3.00	2.10	1.80	1.70	1.60	1.80
8	2.90	2.70	.....	.....	2.70	3.40	3.00	2.10	1.80	1.70	1.60	1.80
9	2.90	2.70	.....	.....	2.50	3.50	3.00	2.00	1.80	1.70	1.60	1.80
10	2.80	2.90	.....	.....	2.70	3.80	3.00	2.00	1.80	1.75	1.60	1.80
11	2.80	2.90	.....	2.30	2.80	3.90	2.90	2.00	1.80	1.70	1.60	1.80
12	2.80	3.00	.....	2.30	3.00	3.60	2.90	2.00	1.80	1.80	1.60	1.80
13	2.80	3.00	.....	2.30	3.00	3.60	2.90	2.00	1.70	1.80	1.50	1.80
14	2.70	3.00	.....	2.40	3.10	3.60	3.10	2.00	1.70	1.80	1.50	1.80
15	2.70	3.00	.....	2.60	3.40	3.70	2.90	2.00	1.70	1.80	1.50	1.80
16	2.70	3.10	.....	2.60	3.30	3.90	2.70	2.00	1.70	1.80	1.50	1.80
17	2.70	3.10	.....	2.40	3.40	4.00	2.70	2.00	1.70	1.80	1.50	1.80
18	2.70	3.10	.....	2.20	3.60	4.10	2.60	2.00	1.70	1.75	1.50	1.70
19	2.70	3.10	.....	2.40	4.20	4.20	2.50	2.00	1.70	1.75	1.55	1.60
20	2.70	3.10	.....	2.60	4.40	4.20	2.40	2.00	1.70	1.75	1.55	1.50
21	2.70	3.10	.....	2.40	4.40	4.10	2.50	1.90	1.70	1.70	1.55	1.40
22	2.70	3.00	.....	2.30	4.80	3.90	2.50	1.90	1.70	1.70	1.50	1.40
23	2.70	3.00	.....	2.10	5.20	4.00	2.50	1.90	1.70	1.70	1.50	1.40
24	2.70	3.00	.....	2.10	5.60	3.80	2.50	1.90	1.70	1.70	1.50	1.40
25	2.70	3.00	.....	2.00	5.30	3.50	2.40	1.90	1.70	1.70	1.50	1.70
26	2.70	.....	.....	2.00	4.60	3.20	2.40	1.90	1.70	1.70	1.50	1.80
27	2.70	.....	.....	2.20	4.10	3.00	2.40	1.90	1.70	1.70	1.50	1.90
28	2.70	.....	.....	2.60	4.00	3.00	2.40	1.90	1.70	1.65	1.50	1.90
29	2.70	.....	.....	2.50	4.00	3.10	2.50	1.90	1.70	1.65	1.50	1.90
30	2.70	.....	.....	2.40	4.10	3.10	2.30	2.00	1.70	1.65	1.50	2.00
31	2.70	.....	.....	.....	4.00	.....	2.30	1.90	.....	1.65	.....	2.10

Rating table for Teton River near St. Anthony, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.40	365	2.50	955	3.60	1,915	4.70	3,550
1.50	410	2.60	1,020	3.70	2,035	4.80	3,740
1.60	460	2.70	1,085	3.80	2,160	4.90	3,925
1.70	510	2.80	1,155	3.90	2,295	5.00	4,115
1.80	560	2.90	1,230	4.00	2,435	5.10	4,310
1.90	610	3.00	1,310	4.10	2,580	5.20	4,515
2.00	665	3.10	1,395	4.20	2,730	5.30	4,725
2.10	720	3.20	1,485	4.30	2,885	5.40	4,940
2.20	775	3.30	1,585	4.40	3,045	5.50	5,160
2.30	835	3.40	1,690	4.50	3,215	5.60	5,385
2.40	895	3.50	1,800	4.60	3,385		

Estimated monthly discharge of Teton River near St. Anthony, Idaho, for 1904.

[Drainage area, 960 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January [a]	1,395	1,085	1,147	70,530	1.19	1.37
February 1–25 [a]	1,395	1,085	1,243	61,640	1.29	1.20
April 11–30	1,020	665	858	34,040	.894	.665
May	5,385	835	2,130	131,000	2.22	2.56
June	2,730	1,310	2,058	122,500	2.14	2.39
July	1,585	835	1,147	70,530	1.19	1.37
August	775	610	667	41,010	.695	.801
September	610	510	537	31,950	.559	.624
October	560	485	520	31,970	.542	.625
November	460	410	432	25,710	.450	.502
December	720	365	512	31,480	.533	.614
The period				652,400		

[a] River frozen; discharge probably too large.

SNAKE RIVER (SOUTH FORK) AT MORAN, WYO.

This station was established September 21, 1903, by Fred Stockton. It is located directly back of the post-office at Moran, Wyo., and about three-fourths of a mile below the outlet of Jackson Lake. A permanent gage was set on October 23, 1904. This gage is a 4 by 4 inch timber anchored well by three vertical timbers. This gage is inclined; 1.85 feet along the gage is equivalent to 1 foot vertical. The gage is graduated to half-tenths of a foot marked with metallic numbers and copper staples; painted white and marked with United States Geological Survey name plate. The gage is read once each day by Lizzie Roche. Discharge measurements are made from a car and cable about 150 feet below gage. The initial point for soundings is on the inner face of cable support on north side of river. The channel is slightly curved for about 300 feet above the station. Below the station the channel is straight. At and above the station the current is smooth and has a well-distributed velocity. Below the station the current is broken by small bowlders. Both banks are high and are not liable to overflow. The right bank is wooded and the left bank is composed of gravel and is without trees. The bed of the stream is composed of firm gravel. There is but one channel at all stages. The bench mark is a United States Geological Survey iron bench-mark post set about 30 feet from the gage. The elevation is 10.77 feet above zero of gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Snake River (South Fork) at Moran, Wyo., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 26 [a]	Wm. G. Davies	395	1,609	4.31	6.16	6,932
September 1 [a]	do	205	370	2.97	1.95	1,101
October 22	do	190	487	1.09	1.25	530

[a] Gaged at Sheffields Bridge.

Mean daily gage height, in feet, of Snake River (South Fork) at Moran, Wyo., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	1.1	1.2	1.5	1.9	6.65	5.4	3.3	2.0	1.5	1.2	1.0
2	1.2	1.1	1.2	1.5	1.9	6.65	5.3	3.3	2.0	1.5	1.2	1.0
3	1.2	1.1	1.2	1.5	1.9	6.7	5.2	3.2	2.0	1.5	1.2	1.0
4	1.1	1.1	1.2	1.5	1.8	6.65	5.1	3.1	2.0	1.5	1.2	1.0
5	1.1	1.1	1.2	1.5	1.9	6.5	5.0	3.0	2.0	1.5	1.1	1.0
6	1.1	1.1	1.3	1.5	2.0	6.35	4.9	2.9	2.0	1.4	1.1	1.0
7	1.1	1.1	1.3	1.4	2.1	6.1	4.8	2.8	2.0	1.4	1.1	1.0
8	1.1	1.1	1.4	1.4	2.2	6.2	4.7	2.7	2.0	1.4	1.1	1.0
9	1.1	1.1	1.4	1.3	2.3	6.1	4.6	2.7	2.0	1.4	1.1	1.0
10	1.1	1.2	1.4	1.3	2.3	6.2	4.5	2.7	2.0	1.4	1.1	1.0
11	1.1	1.2	1.5	1.3	2.4	6.2	4.4	2.7	2.1	1.4	1.1	1.0
12	1.1	1.2	1.5	1.3	2.6	6.2	4.4	2.6	2.1	1.3	1.1	1.0
13	1.1	1.2	1.5	1.3	2.8	6.3	4.4	2.6	2.0	1.3	1.1	1.0
14	1.1	1.2	1.5	1.4	2.9	6.3	4.4	2.6	2.0	1.3	1.1	1.0
15	1.1	1.2	1.5	1.4	3.0	6.4	4.3	2.5	2.0	1.3	1.1	1.0
16	1.1	1.2	1.5	1.4	3.1	6.4	4.2	2.5	2.0	1.3	1.1	1.0
17	1.1	1.2	1.5	1.4	3.1	6.5	4.1	2.4	2.0	1.3	1.1	1.0
18	1.1	1.2	1.5	1.4	3.3	6.6	4.0	2.4	2.0	1.2	1.1	1.0
19	1.1	1.2	1.5	1.5	3.5	6.6	3.9	2.3	1.9	1.2	1.0	1.0
20	1.1	1.2	1.5	1.5	4.1	6.7	3.8	2.3	1.8	1.2	1.0	1.0
21	1.1	1.2	1.5	1.5	4.5	6.7	3.8	2.3	1.8	1.2	1.0	1.0
22	1.1	1.2	1.5	1.6	4.9	6.7	3.8	2.2	1.8	1.1	1.0	1.0
23	1.1	1.2	1.5	1.6	5.3	6.5	3.7	2.2	1.8	1.2	1.0	1.0
24	1.1	1.2	1.5	1.6	6.0	6.3	3.7	2.2	1.8	1.2	1.0	1.0
25	1.1	1.2	1.5	1.6	6.5	6.1	3.6	2.2	1.7	1.2	1.0	1.0
26	1.1	1.2	1.5	1.6	6.7	5.9	3.6	2.1	1.7	1.2	1.0	1.0
27	1.1	1.2	1.5	1.6	6.6	5.7	3.6	2.1	1.7	1.2	1.0	1.0
28	1.1	1.2	1.5	1.7	6.5	5.6	3.5	2.1	1.6	1.2	1.0	1.0
29	1.1	1.2	1.5	1.8	6.5	5.5	3.4	2.0	1.6	1.2	1.0	1.0
30	1.1	.....	1.5	1.8	6.6	5.4	3.4	2.0	1.5	1.2	1.0	1.0
31	1.1	.....	1.5	.....	6.6	.....	3.3	2.0	.....	1.2	.....	1.0

Rating table for Snake River (South Fork) at Moran, Wyo., from September 21, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.00	390	2.50	1,660	4.00	3,530	5.40	5,650
1.10	440	2.60	1,770	4.10	3,670	5.50	5,810
1.20	500	2.70	1,880	4.20	3,810	5.60	5,980
1.30	570	2.80	1,990	4.30	3,950	5.70	6,150
1.40	640	2.90	2,110	4.40	4,100	5.80	6,320
1.50	720	3.00	2,230	4.50	4,250	5.90	6,490
1.60	800	3.10	2,350	4.60	4,400	6.00	6,660
1.70	880	3.20	2,470	4.70	4,550	6.10	6,840
1.80	970	3.30	2,590	4.80	4,700	6.20	7,020
1.90	1,060	3.40	2,720	4.90	4,850	6.30	7,200
2.00	1,150	3.50	2,850	5.00	5,010	6.40	7,380
2.10	1,250	3.60	2,980	5.10	5,170	6.50	7,560
2.20	1,350	3.70	3,110	5.20	5,330	6.60	7,740
2.30	1,450	3.80	3,250	5.30	5,490	6.70	7,930
2.40	1,550	3.90	3,390				

Estimated monthly discharge of Snake River (South Fork) at Moran, Wyo., for 1903 and 1904.

[Drainage area, 820 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
October	720	640	674	41,440	0.822	0.948
November	640	570	596	35,460	.727	.838
December	640	500	561	34,500	.684	.789
1904.						
January	500	440	446	27,420	.544	.627
February	500	440	481	27,670	.587	.633
March	720	500	667	41,010	.813	.937
April	970	570	714	42,490	.871	.972
May	7,930	970	3,561	219,000	4.34	5.00
June	7,930	5,650	7,190	427,800	8.77	9.78
July	5,650	2,590	3,869	237,900	4.72	5.44
August	2,590	1,150	1,695	104,200	2.07	2.39
September	1,250	720	1,059	630,20	1.29	1.44
October	720	440	574	35,290	.700	.807
November	500	390	428	25,470	.522	.582
December	390	390	390	23,980	.476	.549
The year	7,930	390	1,756	1,275,000	2.14	29.16

SNAKE RIVER (SOUTH FORK) NEAR LYON, IDAHO.

This station was established April 18, 1903, by N. S. Dils. It is located at the old site of Wedekind's ferry, between Lyon and Swan Valley, at the upper end of Conant Valley. It is about 45 miles from Idaho Falls, Idaho. A new gage was set on October 16, 1904. It is on the north bank one-fourth mile below Carr's ferry and about 1 mile above location of gaging station. The gage consists of a 4 by 4 inch timber well anchored, graduated and marked to half tenths of a foot by metallic numerals and staples. The gage is inclined; 1.55 feet along the gage corresponds to 1 vertical; 2.01 on the new gage corresponds to 1.75 on the old gage. The new gage is painted white, with a United States Geological Survey name plate. This gage is read once a day by O. J. Carr. The same volume of water flows past each gage.

Discharge measurements are now made from a cable and car at the old site of Wedekind's ferry. A tagged wire has been installed at the cable. The initial point for soundings is the pin in the top of a log of the crib cable support on the left bank. The channel is straight above and below the station, and the current is swift. The right bank is high and steep and will not overflow. At very high stages the left bank will overflow for a considerable distance and some water will pass around the station through a slough. The bed of the stream is composed of hard gravel, free from vegetation, and permanent. Bench mark No. 1 is a United States Geological Survey iron bench-mark post set about 6 feet from the new gage. The elevation is 11.15 above zero of gage. Bench mark No. 2 is a United States Geological Survey aluminum tablet set in a rock on the left bank about 100 feet above Carr's ferry landing, and is about 6 feet above high-water mark. Its elevation is 10.44 feet above zero of gage. This bench mark is for use in high water when ferry service is discontinued.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Snake River (South Fork) near Lyon, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 23	Wm. G. Davies	363	3,459	11.90	8.25	41,160
August 1	do	275	2,140	4.39	3.5	9,407
September 4	J. B. Bond	285	1,664	3.14	2.3	5,213
September 7	Wm. G. Davies	260	1,582	2.84	2.1	4,508
October 17	do	260	1,630	2.13	1.75	3,482

Mean daily gage height, in feet, of Snake River (South Fork) near Lyon, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.52	1.55	1.60	4.40	8.05	6.15	3.65	2.40	1.90	1.50	1.20
2	.....	1.52	1.58	1.60	4.40	8.10	6.00	3.60	2.40	1.90	1.50	1.20
3	1.65	1.52	1.58	1.60	4.40	7.60	5.90	3.50	2.35	1.85	1.50	1.15
4	1.65	1.52	1.58	1.62	4.85	7.20	5.85	3.40	2.35	1.85	1.45	1.10
5	1.65	1.52	1.58	1.65	4.85	7.40	5.80	3.30	2.30	1.85	1.45	1.00
6	1.62	1.52	1.58	1.65	4.90	7.30	5.65	3.20	.....	1.80	1.43	1.00
7	1.62	1.52	1.58	1.70	4.92	7.30	5.50	3.10	.....	1.80	1.40	1.15
8	1.62	1.52	1.60	1.75	4.65	7.10	5.40	3.00	.....	1.80	1.40	1.20
9	1.62	1.52	1.60	1.75	4.40	7.10	5.30	2.90	.....	1.75	1.40	1.15
10	1.62	1.52	1.60	1.80	4.80	7.50	5.20	2.80	.....	1.95	1.37	1.10
11	1.62	1.52	1.60	1.82	5.00	7.60	5.00	2.85	.....	1.95	1.35	1.15
12	1.60	1.52	1.60	1.92	5.20	7.30	5.00	2.80	2.05	1.95	1.30	1.15
13	1.60	1.55	1.60	2.15	5.35	7.00	4.85	2.75	2.05	1.83	1.30	1.20
14	1.60	1.55	1.60	2.30	5.55	7.10	4.75	2.75	2.05	1.80	1.35	1.20
15	1.60	1.55	1.60	2.50	5.80	7.30	4.65	2.75	2.00	1.75	1.30	1.20
16	1.60	1.55	1.60	2.70	5.80	7.50	4.60	2.80	2.00	1.75	1.35	1.15
17	1.60	1.55	1.62	2.90	5.90	7.60	4.50	2.80	2.00	1.75	1.35	1.15
18	1.60	1.55	1.62	3.25	6.20	7.50	4.45	2.80	1.95	1.70	1.35	1.15
19	1.60	1.55	1.62	3.50	6.70	7.55	4.40	2.75	1.95	1.70	1.35	1.15
20	1.60	1.55	1.75	3.80	7.20	7.60	4.35	2.75	1.95	1.70	1.33	1.15
21	1.60	1.55	1.80	3.50	7.30	7.60	4.35	2.65	1.90	1.65	1.30	1.15
22	1.60	1.55	1.65	3.10	7.65	7.50	4.30	2.60	1.90	1.65	1.30	1.15
23	1.60	1.55	1.65	2.80	8.25	7.40	4.25	2.55	1.95	1.65	1.27	1.10
24	1.55	1.55	1.62	3.00	8.90	7.25	4.20	2.40	1.95	1.60	1.25	1.10
25	1.55	1.55	1.62	3.10	9.05	7.60	4.10	2.45	1.95	1.60	1.25	1.15
26	1.55	1.55	1.62	3.45	8.35	6.40	4.05	2.45	1.90	1.60	1.25	1.05
27	1.55	1.55	1.60	3.95	7.50	6.30	4.00	2.50	1.90	1.60	1.25	0.85
28	1.55	1.55	1.60	4.50	7.50	6.20	4.00	2.60	1.90	1.60	1.25	0.85
29	1.55	1.55	1.60	4.45	7.80	6.00	3.90	2.55	1.90	1.55	1.25	1.15
30	1.55	1.55	1.60	4.45	7.75	6.10	3.80	2.50	1.85	1.55	1.25	1.20
31	1.55	1.55	1.60	.....	7.80	.....	3.70	2.45	.....	1.55	.....	1.20

NOTE.—The above gage heights refer to the old gage.

Rating table for Snake River (South Fork) near Lyon, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.80	1,400	2.30	5,160	3.70	10,200	5.20	16,800
.90	1,590	2.40	5,480	3.80	10,600	5.40	17,760
1.00	1,790	2.50	5,800	3.90	11,020	5.60	18,780
1.10	2,000	2.60	6,120	4.00	11,440	5.80	19,840
1.20	2,220	2.70	6,460	4.10	11,860	6.00	20,980
1.30	2,440	2.80	6,800	4.20	12,280	6.20	22,200
1.40	2,670	2.90	7,140	4.30	12,720	6.40	23,500
1.50	2,910	3.00	7,500	4.40	13,160	6.60	24,950
1.60	3,160	3.10	7,860	4.50	13,600	6.80	26,500
1.70	3,420	3.20	8,240	4.60	14,040	7.00	28,200
1.80	3,690	3.30	8,620	4.70	14,480	7.50	32,900
1.90	3,970	3.40	9,000	4.80	14,940	8.00	38,300
2.00	4,260	3.50	9,400	4.90	15,400	8.50	44,300
2.10	4,560	3.60	9,800	5.00	15,860	9.00	50,800
2.20	4,860						

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.70 feet and 3.50 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Snake River (South Fork) near Lyon, Idaho, for 1904.

[Drainage area, 5,480 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	3,290	3,035	3,159	194,200	0.576	0.664
February	3,035	2,960	3,004	172,800	.548	.591
March	3,690	3,035	3,195	196,500	.583	.672
April	13,600	3,160	6,639	395,000	1.21	1.35
May	51,450	13,160	24,820	1,526,000	4.53	5.22
June	39,500	20,980	30,720	1,828,000	5.61	6.26
July	21,890	10,200	14,970	920,500	2.73	3.15
August	10,000	5,480	6,972	428,700	1.27	1.46
September	5,480	3,830	4,451	264,800	.812	.906
October	4,115	3,035	3,534	217,300	.645	.744
November	2,910	2,330	2,546	151,500	.465	.519
December	2,220	1,495	2,057	126,500	.375	.432
The year	51,450	1,495	8,839	6,421,800	1.61	21.97

NOTE.—Discharge interpolated for missing gage heights.

WILLOW CREEK NEAR PROSPECT, IDAHO.

This station was established April 21, 1903, by N. S. Dils. It is located at the ranch of Thomas L. Wails, 3 miles east of Prospect and 17 miles from Idaho Falls, Idaho. The temporary gage is a vertical 2 by 4 inch rod driven into the bed of the creek and fastened at the top to a willow root. It is read twice each day by Thomas L. Wails. There is a bridge below the gage at which discharge measurements may be made. The creek is crooked and the banks are covered with willows. Both banks are high and are not liable to overflow except in case of extreme high water, as in 1904. The bed of the stream is composed of mud. When the water is low in the creek water is discharged into it through a canal one-half mile below the temporary gage. This is a temporary station and was discontinued October 8, 1904.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Willow Creek near Prospect, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 25	Wm. G. Davies	51	511	2.0	7.15	1,108
July 23	do	51	384	0.20	4.05	[a] 79

[a] Backwater.

Mean daily gage height, in feet, of Willow Creek near Prospect, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.20			2.15	7.75	5.95	4.40	3.80	1.90	2.70
2	2.20			1.95	8.15	6.10	4.40	3.80	2.30	2.90
3	2.20			1.90	8.80	5.90	4.30	3.80	3.40	2.90
4	2.20			2.05	8.90	5.90	4.05	3.80	3.40	2.90
5	2.20			2.20	10.10	6.05	4.15	3.70	3.40	2.90
6	2.20			2.25	9.90	6.00	4.10	3.80	3.20	3.00
7	2.15			2.40	9.30	5.90	3.90	3.80	2.80	3.00
8	2.10			2.20	9.10	5.50	3.90	3.70	2.80	([a])
9	2.10			2.20	8.80	5.40	4.50	3.70	2.80	
10	([b])			2.20	8.60	5.35	4.05	3.70	2.80	
11				2.30	9.10	5.35	4.10	3.70	2.90	
12				2.55	9.10	5.50	3.80	3.80	2.90	
13				2.85	8.70	5.40	4.10	3.80	2.90	
14				3.25	8.30	5.40	4.20	3.70	2.90	
15				3.50	8.00	5.50	4.00	3.70	2.90	
16				4.35	8.30	5.40	3.90	3.70	2.90	
17				4.60	8.20	5.40	3.85	3.80	2.90	
18			1.90	4.40	7.95	5.40	3.95	3.80	2.80	
19			2.15	4.50	7.75	5.30	4.00	3.80	2.80	
20			2.35	5.35	7.75	5.20	4.00	3.80	2.90	
21			2.50	5.70	7.80	5.20	4.10	3.80	2.80	

[a] Station discontinued. [b] River frozen from January 10 to March 17, inclusive.

Mean daily gage height, in feet, of Willow Creek near Prospect, Idaho, for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
22	.....	.....	2.40	5.85	7.80	4.90	4.00	3.70	3.00	.....
23	.....	.....	2.40	4.90	7.65	4.80	4.00	3.60	3.00	.....
24	.....	.....	2.30	4.65	7.35	4.90	4.00	3.60	3.00	.....
25	.....	.....	2.10	4.20	7.10	4.70	3.90	3.60	2.25	.....
26	.....	.....	2.00	4.25	6 80	4.80	3.90	3.30	2.10	.....
27	.....	.....	2.00	5.35	6.50	4.90	3.90	3.30	2.10	.....
28	.....	.....	2.00	6.55	6.35	4.50	3.80	3.10	2.10	.....
29	.....	.....	2.10	7.70	6.05	4.40	3.90	3.00	2.20	.....
30	.....	.....	2.20	7.70	6.00	4.40	3.90	2.10	2.40	.....
31	.....	.....	2.20	.....	5.80	.....	3.80	2.00	.....	.....

BLACKFOOT RIVER NEAR PRESTO, IDAHO.

This station was established April 17, 1903, by N. S. Dils, and a temporary gage was set. It is located on the ranch of the observer, James Just, 2 miles west of Presto and about 15 miles from Blackfoot, Idaho. A permanent gage was set October 13, 1904. This gage consists of an inclined 4 by 4 inch timber having 1.36 feet on the gage equivalent to 1 foot vertical. The gage is graduated to half-tenths of a foot, marked with metallic numerals, copper staples, and a United States Geological Survey name plate. Discharge measurements are made from a cable and car located about one-fourth mile below the gage. The initial point for sounding is a tag marked "I. P." fastened to the inner face of the cable support on the west bank. The current is sluggish. The banks are high and wooded and will not overflow. The bed of the stream is gravel, free from vegetation, and permanent. The bench mark is a copper plug set in corner stone of James Just's brick house. The elevation is 12.18 above the zero of the gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Blackfoot River near Presto, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 4	Fred Stockton	60	441	2.70	6.6	[a] 1,193
June 14	Wm. G. Davies	54	208	2.44	2.65	508
July 2	J. B. Bond	54	160	1.26	1.1	220
July 27	do	53	125	1.11	0.7	146
August 30	do	53	161	1.48	1.1	235

[a] Surface velocity taken.

Mean daily gage height, in feet, of Blackfoot River near Presto, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	(a)	.....	.....	1.1	5.7	3.75	1.1	0.7	0.9	1.1	1.4	1.1
2	.....	.....	.....	1.0	5.85	3.95	1.1	.7	.9	1.1	1.35	1.1
3	.....	.....	.....	1.1	5.75	3.85	1.1	.7	.9	1.2	1.3	1.2
4	.....	.....	.....	1.1	6.3	3.8	1.1	.7	.9	1.2	1.3	1.2
5	.....	.....	.....	1.2	6.85	3.6	1.1	.7	.9	1.2	1.3	1.15
6	.....	.....	1.0	1.3	6.65	3.65	1.1	.7	.9	1.2	1.3	1.3
7	.....	.....	1.1	1.3	6.75	3.5	1.1	.7	.9	1.2	1.3	1.2
8	.....	.....	1.4	1.3	7.0	3.5	1.1	.7	.9	1.2	1.3	1.4
9	.....	.....	1.4	1.4	7.05	3.35	1.0	.7	.9	1.2	1.3	1.4
10	.....	.....	1.2	1.4	6.7	3.25	1.0	.7	.9	1.2	1.3	1.2
11	.....	.....	1.1	1.5	6.3	3.2	1.0	.7	.9	1.3	1.3	(a)
12	.....	.....	1.1	1.8	6.25	3.0	.9	.7	.9	1.3	1.25	.....
13	.....	.....	1.2	2.1	6.05	2.9	.9	.7	.9	1.3	1.25	.....
14	.....	.....	1.1	2.65	6.25	2.7	.9	.8	1.0	1.3	1.2	.....
15	.....	.....	1.1	3.15	6.45	2.5	.9	.8	1.0	1.3	1.2	.....
16	.....	.....	1.1	4.2	6.05	2.2	.8	.8	1.0	1.3	1.2	.....
17	.....	.....	1.1	4.4	5.8	2.2	.8	.8	1.0	1.3	1.2	.....
18	.....	.....	1.2	4.65	5.7	2.1	.8	.8	1.0	1.3	1.2	.....
19	.....	.....	1.4	5.5	5.45	2.0	.8	.8	1.0	1.35	1.2	.....
20	.....	.....	1.6	6.75	5.3	1.8	.8	.8	1.1	1.35	1.2	.....
21	.....	.....	1.4	6.9	5.45	1.6	.8	.8	1.1	1.35	1.2	.....
22	.....	.....	1.4	6.1	5.3	1.5	.7	.8	1.1	1.4	1.2	.....
23	.....	.....	1.3	5.65	5.05	1.5	.7	.8	1.1	1.4	1.15	.....
24	.....	.....	1.3	5.2	5.0	1.4	.7	.8	1.1	1.4	1.15	.....
25	.....	.....	1.2	5.05	4.9	1.4	.7	.8	1.1	1.4	1.15	.....
26	.....	.....	1.3	5.1	4.75	1.3	.7	.8	1.1	1.4	1.15	.....
27	.....	.....	1.3	5.55	4.65	1.2	.7	.8	1.1	1.4	1.1	.....
28	.....	.....	1.2	5.7	4.4	1.2	.7	.8	1.1	1.4	1.1	.....
29	.....	.....	1.2	5.6	4.2	1.2	.7	.9	1.1	1.4	1.1	.....
30	.....	.....	1.1	5.4	4.0	1.2	.7	.9	1.1	1.4	1.1	.....
31	.....	.....	1.1	.....	3.85	.....	.7	.9	.....	1.4	.....	.....

a River frozen from January 1 to March 5, and December 11 to 31, inclusive.

BIG LOST RIVER NEAR MACKAY, IDAHO.

This station was established November 12, 1903, by Fred Stockton and a temporary gage was set. It is located 3½ miles above Mackay, Idaho, above "The Narrows." A permanent gage was set November 3, 1904, at "The Narrows," about a mile below the temporary gage. It is located back of Joseph Cresto's (the observer) house and consists of a 4 by 4 inch post set vertical and securely anchored, graduated to one-half tenths of a foot, and marked with a United States Geological Survey name plate. Gagings are made from a cableway at the original station site. All gage heights for 1904 were taken from the temporary gage. On November 30, 1904, the temporary gage read 0.90, the permanent gage read 2.80, the discharge being the same at both places.

The channel of the stream is slightly curved both above and below the station. The south bank is steep and high and does not overflow, the north bank slopes gradually and will overflow during high water.

The initial point for soundings is a tin tag marked "I. P." on the inside face of cable support on north bank of stream. A United States Geological Survey iron bench-mark post is set about 15 feet from gage. The elevation is 9.83 above zero of gage.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Big Lost River near Mackay, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 3	Wm. G. Davies	55	222	5.22	3.1	1,162
July 29	J. B. Bond	42	140	3.70	1.7	524
August 18	do	39	112	2.83	1.2	317
September 7	do	38	95	2.48	.9	236
November 3	Wm. G. Davies	36	90	2.05	.95	185

Mean daily gage height, in feet, of Big Lost River near Mackay, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.7	0.65	0.7	0.7	.....	3.8	3.3	1.5	1.0	0.85	0.95	0.85
2	.7	.65	.7	.7	.....	3.9	3.2	1.5	1.0	.85	.95	.85
3	.7	.65	.7	.7	.....	3.7	3.2	1.5	1.0	.85	.95	.85
4	.7	.65	.7	.7	0.5	3.3	3.1	1.4	1.0	.85	.95	.85
5	.7	.65	.7	.7	.55	3.1	3.0	1.4	.9	.85	.95	.85
6	.7	.65	.7	.7	.55	3.0	2.9	1.3	.95	.85	.95	.85
7	.7	.65	.7	.7	.5	3.4	2.8	1.3	.95	.85	.95	.85
8	.7	.65	.7	.7	.55	3.4	2.8	1.3	.95	.85	.95	.85
9	.7	.65	.7	.7	.55	3.4	2.7	1.3	.95	.85	.95	.85
10	.7	.65	.7	.7	.55	3.8	2.8	1.3	.95	.85	.95	.85
11	.7	.65	.7	.7	.5	3.9	2.6	.....	.95	.85	.95	.85
12	.7	.65	.7	.7	.5	3.6	2.6	.....	.95	.95	.95	.85
13	.7	.65	.7	.7	.7	3.4	2.6	.....	.95	.95	.9	.85
14	.7	.65	.7	.7	1.0	3.5	2.6	.....	.95	.95	.9	.85
15	.7	.65	.7	.7	1.3	3.8	2.4	.....	.95	.95	.9	.85
16	.7	.65	.7	.7	1.6	3.9	2.2	1.2	.95	.95	.9	.85
17	.7	.65	.7	.7	1.7	4.2	2.0	1.2	.85	.95	.9	.85
18	.7	.65	.7	.7	2.0	4.4	1.9	1.2	.85	.95	.9	.85
19	.7	.65	.7	.7	2.3	4.4	1.8	1.1	.85	.95	.9	.85
20	.7	.65	.7	.7	2.3	4.4	1.9	1.1	.85	.95	.9	.85
21	.7	.65	.7	.65	2.5	4.1	1.8	1.0	.85	.95	.9	.85
22	.7	.65	.7	.65	2.7	4.0	1.9	1.0	.85	.95	.9	.85
23	.7	.65	.7	.65	3.3	4.0	1.9	1.0	.85	.95	.9	.85
24	.7	.65	.7	.65	3.9	3.9	2.0	1.0	.85	.95	.9	.85
25	.7	.65	.7	.65	4.2	3.5	1.9	1.0	.85	.95	.9	.85
26	.7	.65	.7	.65	4.1	3.2	1.8	1.0	.85	.95	.9	.8
27	.7	.7	.7	.6	3.6	3.0	1.8	1.0	.85	.95	.9	.8
28	.7	.7	.7	.6	3.3	3.0	1.8	1.0	.85	.95	.9	.8
29	.7	.7	.7	.6	3.4	3.1	1.7	1.0	.85	.95	.9	.8
30	.7	.....	.7	.6	3.6	3.2	1.7	1.0	.85	.95	.9	.8
31	.7	.....	.7	.....	3.6	.....	1.6	1.0	.....	.95	.....	.8

Rating table for Big Lost River near Mackay, Idaho, from November 12, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.60	175	1.60	480	2.50	890	3.40	1,300
.70	195	1.70	525	2.60	935	3.50	1,345
.80	215	1.80	570	2.70	980	3.60	1,390
.90	235	1.90	615	2.80	1,025	3.70	1,435
1.00	260	2.00	660	2.90	1,070	3.80	1,480
1.10	285	2.10	710	3.00	1,120	3.90	1,525
1.20	315	2.20	755	3.10	1,165	4.00	1,570
1.30	350	2.30	800	3.20	1,210	4.10	1,620
1.40	390	2.40	845	3.30	1,255	4.20	1,665
1.50	435						

The above table is applicable for open-channel conditions only. It is based upon 5 discharge measurements made during 1904. It is fairly well defined.

Estimated monthly discharge of Big Lost River near Mackay, Idaho, for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
December	195	195	195	11,990
1904.				
January	195	195	195	11,990
February	195	185	186	10,700
March	195	195	195	11,990
April	195	175	190	11,310
May [a]	1,665	160	668	41,070
June	1,755	1,120	1,410	83,900
July	1,255	480	813	49,990
August [b]	435	260	318	19,550
September	260	225	238	14,160
October	248	225	240	14,760
November	248	235	240	14,280
December	225	215	223	13,710
The year	1,755	160	410	297,400

[a] Discharge May 1–3 interpolated.

[b] Discharge August 11–15 interpolated.

BIG LOST RIVER NEAR CHILLY, IDAHO.

This station was established April 25, 1904, by Fred Stockton. It is located at Frank Uehren's ranch, about 25 miles upstream from Mackay, 7 miles from Chilly, and about 3 miles above Kinickinick Point. This ranch is the last one on the east bank.

The gage is about one-fourth mile from the ranch house. The gage consists of a 4 by 4 inch timber set vertical, well braced and anchored, and graduated to half tenths of a foot. The graduations are marked by metallic numerals and staples. The gage is painted white and marked with U. S. G. S. name plate. A permanent gage was set November 1, 1904, at the same elevation as the temporary gage. Discharge measurements are made from a cable and car located about three-fourths mile above Uehren's house. The initial point for soundings is a tin tag marked "I. P." on the face of the cable support on east side. The channel is straight for about 200 feet above and 250 feet below the station. Both banks are low and liable to overflow during high water. The stream has but one channel during all stages. A United States Geological Survey iron bench-mark post has been set about 10 feet from the gage. The elevation is 7.49 feet above the zero of the gage. The observer is Frank Uehren.

The observations at this station during 1904 have been made under directions of D. W. Ross, district engineer.

Discharge measurements of Big Lost River near Chilly, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 4	Wm. G. Davies	80	280	4.39	4.35	1,230
July 29	J. B. Bond	80	195	2.98	3.0	550
August 18	do	80	156	1.85	2.4	309
September 7	do	80	135	1.28	1.8	178
November 1	Wm. G. Davies	80	120	.84	1.57	106

Mean daily gage height, in feet, of Big Lost River near Chilly, Idaho, for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.1	4.6	4.3	2.8	2.0	1.65	1.6	2.0
2	.....	1.95	4.4	4.2	2.8	1.95	1.6	1.6	2.0
3	.....	1.95	.....	4.3	2.7	2.0	1.6	1.6	2.0
4	.....	2.2	4.3	.....	.....	1.9	1.6	1.55	2.0
5	.....	2.4	4.35	.....	2.7	1.9	1.6	1.6	2.0
6	.....	2.5	4.45	3.8	2.6	1.85	1.6	1.55	2.3
7	.....	2.7	4.25	3.9	2.55	1.85	1.6	1.6	2.3
8	.....	2.7	4.5	3.9	2.55	1.9	1.7	.....	2.3
9	.....	2.9	4.8	3.9	2.5	1.8	1.7	.....	2.2
10	.....	3.1	4.95	3.9	2.5	1.8	1.65	1.6	2.1
11	.....	3.2	4.4	3.7	2.5	1.8	1.6	1.6	2.1
12	.....	3.3	4.15	4.0	2.45	.....	1.6	1.55	2.0
13	.....	3.4	4.3	3.9	2.4	1.8	1.6	1.6	2.0
14	.....	3.8	4.3	3.6	2.45	1.75	.....	1.6	1.9
15	.....	3.9	4.6	3.4	.....	1.7	1.6	1.6	1.7
16	.....	3.9	.....	3.1	2.5	1.7	1.6	1.6	1.6
17	.....	4.05	4.8	3.2	2.4	1.7	1.6	1.5	1.6
18	.....	4.25	4.85	3.05	2.3	1.7	1.65	1.5	1.6
19	.....	4.2	5.1	3.1	2.3	1.7	1.7	1.5	1.5
20	.....	4.1	4.8	3.1	2.2	1.7	1.6	1.5	1.2
21	.....	4.6	4.7	.....	2.1	1.7	1.6	1.5	1.15
22	.....	4.9	4.6	3.2	2.1	1.7	1.6	1.5	1.3
23	.....	5.0	4.35	3.3	.....	1.7	1.6	1.5	1.4
24	.....	4.9	3.9	3.2	2.0	1.7	1.6	1.5	1.5
25	1.7	4.9	4.0	3.2	2.0	.....	1.6	1.5	1.5
26	1.9	4.3	4.1	3.0	2.0	1.7	1.6	1.5	1.3
27	2.15	4.0	4.0	3.1	2.1	1.7	1.6	1.6	1.3
28	2.1	4.2	4.1	3.05	2.0	1.7	1.6	1.6	1.25
29	2.0	4.45	4.6	3.0	2.0	1.7	1.6	1.6	.....
30	2.0	4.5	.....	2.9	2.05	1.65	.....	1.6	.....
31	.....	4.6	.....	2.85	2.05	.....	.....	.....	1.3

Rating table for Big Lost River near Chilly, Idaho, from April 25 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.10	65	2.20	260	3.20	650	4.20	1,155
1.20	80	2.30	285	3.30	700	4.30	1,205
1.30	95	2.40	310	3.40	750	4.40	1,255
1.40	110	2.50	340	3.50	800	4.50	1,305
1.50	125	2.60	370	3.60	850	4.60	1,355
1.60	140	2.70	410	3.70	900	4.70	1,405
1.70	160	2.80	450	3.80	950	4.80	1,455
1.80	180	2.90	500	3.90	1,000	4.90	1,505
1.90	200	3.00	550	4.00	1,050	5.00	1,555
2.00	220	3.10	600	4.10	1,105	5.10	1,605
2.10	240						

The foregoing table is applicable for open-channel conditions only. It is based upon 4 discharge measurements made during 1904. It is well defined between 1.80 feet and 3.00 feet gage height. Above 3.00 feet the table depends on one measurement at 4.35 feet gage height.

Estimated monthly discharge of Big Lost River near Chilly, Idaho, for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 25–30	250	160	215	2,559
May	1,555	210	898	55,220
June [a]	1,605	1,000	1,284	76,410
July [a]	1,205	475	799	49,130
August [a]	450	220	307	18,880
September [a]	220	150	175	10,410
October [a]	160	140	143	8,793
November [a]	140	125	134	7,974
December [a]	285	73	168	10,330
The period				239,700

[a] Discharge for missing gage heights interpolated.

BIG WOOD RIVER NEAR GIMLET, IDAHO.

This station was established by Fred Stockton on April 25, 1904. It is located on a wagon bridge on the road from Hailey to Ketchum, near Gimlet station on the Oregon Short Line Railroad, a small station about 6 miles from Hailey and 6 miles from Ketchum. The bridge is about 200 feet below the railroad bridge crossing Big Wood River. The gage consists of a 2 by 4 inch timber spiked against a timber on the up-stream side of the north end abutment to the wagon bridge. This gage is graduated to half-tenths of a foot. Graduations are marked by metallic numbers and staples. The gage is marked with a United States Geological Survey name plate. Discharge measurements are made from the bridge. The initial point for soundings is a tin tag marked "I. P." nailed on the hand rail on the downstream side of the bridge. The channel is straight for 250 feet above and 1,000 feet below the bridge. The banks are high and covered with brush and are not liable to overflow, and the stream has but one channel in either high or low water. The bench mark is a United States Geological Survey iron bench-mark post set in the dooryard of the first ranch house above Gimlet. Its elevation above sea level is 5,544 feet and 15.09 feet above zero of gage. The observer is C. A. Comstock.

The observations at this station during 1904 have been under the direction of D. W. Ross, district engineer.

Discharge measurements of Big Wood River near Gimlet, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 29	Wm. G. Davies	88	214	3.77	1.82	806
May 14	do	88	314	5.71	3.15	1,794
July 8	J. B. Bond	92	239	4.91	2.30	1,293
August 3	do	55	170	3.49	1.25	620
November 10	Wm. G. Davies	37	151	1.25	.75	189

Mean daily gage height, in feet, of Big Wood River near Gimlet, Idaho, for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.7	3.8	2.5	1.2	0.8	0.7	0.7	0.65
2		1.7	3.8	2.7	1.2	.8	.7	.7	.65
3		1.9	3.6	2.6	1.2	.8	.7	.7	.65
4		2.2	3.3	2.4	1.2	.8	.7	.7	.65
5		2.4	3.3	2.3	1.2	.8	.7	.7	.65
6		2.5	3.5	2.2	1.2	.8	.7	.7	.65
7		2.6	3.4	2.2	1.2	.7	.7	.7	.65
8		2.5	3.3	2.3	1.1	.7	.7	.7	.65
9		2.5	3.7	2.3	1.1	.7	.7	.7	.65
10		2.8	3.5	2.2	1.1	.7	.7	.65	.65
11		2.9	3.2	2.1	1.1	.7	.7	.65	.65
12		2.9	3.3	2.0	1.0	.7	.7	.65	.65
13		3.0	3.4	1.9	1.0	.7	.7	.65	.65
14		3.2	3.5	1.8	1.0	.7	.7	.65	.65
15		3.4	3.6	1.6	1.0	.7	.7	.65	.65
16		3.3	3.7	1.6	1.3	.7	.7	.65	.65
17		3.6	3.9	1.5	1.2	.7	.7	.65	.65
18		3.5	3.9	1.5	1.1	.7	.7	.65	.6
19		3.6	3.8	1.5	1.1	.7	.7	.65	.6
20		3.6	3.6	1.5	1.0	.7	.6	.65	.6
21		4.1	3.7	1.5	1.0	.7	.7	.65	.6
22		4.6	3.5	1.5	1.0	.7	.7	.65	.6
23		4.8	3.3	1.4	1.0	.7	.7	.65	.6
24		5.1	3.0	1.4	1.0	.7	.7	.65	.6
25		5.2	2.9	1.4	.9	.7	.7	.65	.6
26		4.9	2.5	1.4	.9	.7	.7	.65	.6
27		3.8	2.6	1.3	.9	.7	.7	.65	.6
28	1.8	3.8	2.5	1.3	.9	.7	.7	.65	.6
29	1.8	3.8	2.5	1.3	.9	.7	.7	.65	.6
30	1.8	3.9	2.6	1.2	.9	.7	.7	.65	.6
31		3.8		1.2	.9		.7		.6

LITTLE WOOD RIVER NEAR CAREY, IDAHO.

This station was established on April 28, 1904, by William G. Davies. It is located 7 miles upstream from Carey on the Carey-Muldoon road, about one-half mile above dam at head of east and west

side canals, and above the slough or delta section of the river. This station is 35 miles from Picabo, the nearest railroad point. The gage is a 4 by 4 inch timber, set vertical, and bolted to a lava wall. It is graduated to half-tenths of a foot, the graduation being marked by metallic numerals and staples. The gage is painted white and marked with a United States Geological Survey name plate. It is set on the east bank of the river. Discharge measurements are made from a cable and car. The initial point for soundings is a tin tag marked "I. P." on an iron anchor set in a rock on west bank. The channel is straight both above and below the station. The banks are high and clean and not liable to overflow. The stream has one channel at both high and low water and its bed is smooth and clean. The bench mark is a United States Geological Survey aluminum bench-mark tablet set 3 feet from the gage in solid lava. The elevation is 6.00 feet above zero of the gage. Mrs. F. M. Ford is the observer.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Little Wood River near Carey, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 12	Wm. G. Davies	48	128	4.23	2.75	542
July 9	J. B. Bond	46	98	4.49	2.2	457
August 4	do	45	62	2.57	1.4	163
November 9 [a]	Wm. G. Davies	38	.79	.85	1.05	67

[a] Gaged above the station.

Mean daily gage height, in feet, of Little Wood River near Carey, Idaho, for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.55	3.4	2.2	1.4	1.0	0.9	1.0	1.0
2		4.8	3.4	2.1	1.4	1.0	.9	1.0	1.0
3		4.1	3.1	2.1	1.4	1.0	.9	1.0	1.0
4		4.15	2.9	2.1	1.4	1.0	.9	1.0	1.0
5		4.5	2.8	2.1	1.4	1.0	.9	1.0	1.0
6		4.15	2.8	2.2	1.4	1.0	1.0	1.0	1.0
7		4.35	3.0	2.2	1.3	1.0	1.0	1.0	1.0
8		4.15	2.9	2.1	1.3	1.0	1.0	1.0	1.0
9		4.35	2.9	2.0	1.3	.9	1.0	1.0	1.0
10		4.4	3.0	2.0	1.3	.9	1.0	1.0	1.0
11		4.6	2.9	1.9	1.2	.9	1.0	1.0	1.0
12		5.0	2.7	2.0	1.2	.9	1.0	1.0	1.0
13		4.75	2.8	2.0	1.2	.9	1.0	1.0	1.0
14		4.95	2.8	2.0	1.2	.9	1.0	1.0	1.0
15		4.05	2.8	2.0	1.2	.9	1.0	1.0	1.0
16		4.25	3.0	2.0	1.2	.9	1.0	1.0	1.0
17		4.15	3.0	1.7	1.3	.9	1.0	1.0	1.0

Mean daily gage height, in feet, of Little Wood River near Carey, Idaho, for 1904—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
18	.....	4.1	3.0	1.6	1.2	.9	1.0	1.0	1.0
19	.....	4.1	3.0	1.5	1.2	0.9	1.0	1.0	1.0
20	.....	4.75	2.9	1.4	1.2	.9	1.0	1.0	1.0
21	.....	5.05	2.8	1.4	1.2	.9	1.0	1.0	1.0
22	.....	5.1	2.7	1.4	1.1	1.0	1.0	1.0	1.0
23	.....	5.05	2.8	1.5	1.1	.9	1.0	1.0	1.0
24	.....	5.0	2.4	1.4	1.0	.9	1.0	1.0	1.0
25	.....	4.7	2.0	1.4	1.0	.9	1.0	1.0	1.0
26	.....	4.1	2.4	1.3	1.0	.9	1.0	1.0	1.0
27	.....	3.7	2.3	1.3	1.0	1.0	1.0	1.0	1.0
28	4.00	3.6	2.2	1.2	1.0	1.0	1.0	1.0	1.0
29	3.95	3.6	2.2	1.2	1.0	1.0	1.0	1.0	1.0
30	4.10	3.7	2.2	1.2	1.0	1.0	1.0	1.0	1.0
31	.....	3.4	.....	1.3	1.0	.....	1.0	.....	1.0

SUCCOR CREEK NEAR HOMEDALE, IDAHO.

This station was established March 19, 1903, by N. S. Dils. It was discontinued September 30, 1903, but was taken up again before water began flowing in the winter. It is located at a small truss bridge built to carry a flume and is about one-half mile above the mouth of the river. The gage is a vertical rod driven into the bed of the stream, fastened to the downstream side of the footbridge. A new station was established January 31, 1905, about half a mile above the old station and about 17 miles from Caldwell, the nearest railroad station. It is 1 mile west of Homedale, near the Caldwell-Jordan Valley stage road, and 1 mile west of Mussel's ferry on Snake River. This gaging station is one-fourth of a mile below the head of the lowest ditch on Succor Creek, and about three-fourths of a mile above the mouth of the creek. The new gage consists of a 4 by 4 inch post inclined so that 1.27 feet along gage represents 1 foot vertically. This gage is well anchored and bolted, graduated to feet and tenths. The graduations are marked by metallic numbers and staples marked with a United States Geological Survey name plate. The gage is on the left bank of the stream about one-third of a mile above the house of Mrs. Minnie Tracy, the observer. Discharge measurements are made from a cable and car which are located about 10 feet above gage. The initial point for soundings is the inside face of cable support on left bank of stream. The river channel is straight for about 200 feet above and below the station. The bed of stream is gravelly and has one channel at all stages. The right bank is low and slopes uniformly, and may overflow during high water. The left bank is high and not liable to overflow.

A United States Geological Survey iron bench-mark post is set 10 feet back from gage. The elevation is 9.88 feet above the gage zero.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Succor Creek near Homedale, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 19	F. Stockton	30	58	1.35	2.65	78
May 12	do	42	42	1.07	3.40	[a] 45

[a] Backwater.

Mean daily gage height, in feet, of Succor Creek near Homedale, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.4	2.8	3.25	2.85	2.65	.....	.....	.....	.....	.....	.....
2	2.6	2.4	2.65	3.4	3.0	2.45	.....	.....	.....	.....	.....	.....
3	2.6	2.4	2.6	3.35	2.95	2.2	.....	.....	.....	.....	.....	.....
4	2.6	2.4	2.65	3.25	3.0	2.05	.....	.....	.....	.....	.....	.....
5	2.6	2.45	2.4	3.2	3.0	1.9	.....	.....	.....	.....	.....	.....
6	2.6	2.55	2.75	3.3	3.0	2.0	.....	.....	.....	.....	.....	.....
7	2.6	2.5	4.25	3.4	3.0	2.0	.....	.....	.....	.....	.....	.....
8	2.6	2.45	4.15	3.4	3.0	2.0	.....	.....	.....	.....	.....	.....
9	2.6	2.4	4.4	3.2	3.05	1.9	.....	.....	.....	.....	.....	.....
10	2.6	2.4	4.1	3.25	3.45	1.25	.....	.....	.....	.....	.....	.....
11	3.45	2.5	4.5	3.55	3.5	1.25	.....	.....	.....	.....	.....	.....
12	3.0	2.5	3.55	3.5	3.45	1.15	.....	.....	.....	.....	.....	.....
13	3.05	2.75	3.3	3.5	3.5	1.05	.....	.....	.....	.....	.....	.....
14	2.65	2.6	3.25	3.5	2.55	1.0	.....	.....	.....	.....	.....	.....
15	2.6	3.75	3.15	3.45	1.6	1.0	.....	.....	.....	.....	.....	.....
16	2.65	4.25	3.0	3.45	1.6	([a])	.....	.....	.....	.....	.....	.....
17	2.65	3.75	2.95	3.2	1.65	.....	.....	.....	.....	.....	.....	.....
18	2.6	3.45	3.95	3.15	1.65	.....	.....	.....	.....	.....	.....	.....
19	2.6	3.15	3.35	3.25	1.65	.....	.....	.....	.....	.....	.....	.....
20	2.5	3.0	3.65	3.95	1.7	.....	.....	.....	.....	.....	.....	.....
21	2.5	2.75	3.15	3.6	1.65	.....	.....	.....	.....	.....	.....	.....
22	2.5	5.25	3.05	3.3	1.6	.....	.....	.....	.....	.....	.....	.....
23	2.5	5.0	2.95	3.1	1.55	.....	.....	.....	.....	.....	.....	.....
24	2.5	5.15	2.9	3.1	1.65	.....	.....	.....	.....	.....	.....	.....
25	2.4	4.75	2.8	3.05	1.75	.....	.....	.....	.....	.....	.....	.....
26	2.4	4.1	2.8	3.0	2.15	.....	.....	.....	.....	.....	.....	.....
27	2.4	3.55	2.8	2.9	2.25	.....	.....	.....	.....	.....	.....	.....
28	2.4	3.0	3.25	2.95	2.4	.....	.....	.....	.....	.....	.....	.....
29	2.4	2.95	5.85	2.9	2.65	.....	.....	.....	.....	.....	.....	.....
30	2.4	.....	5.1	2.8	2.85	.....	.....	.....	.....	.....	.....	3.5
31	2.4	.....	4.3	.....	2.9	.....	.....	.....	.....	.....	.....	4.0

[a] River dry June 16 to December 29, inclusive.

OWYHEE RIVER NEAR OWYHEE, OREG.

This station was established August 27, 1903, by John H. Lewis. It is located at the county bridge 1½ miles from Owyhee, Oreg. A large irrigation ditch takes water from the river about 6 miles above. The gage is an inclined 2 by 6 inch timber reading from 1 to 5 feet.

It is located at the upstream steel caisson of the left abutment of the bridge. The gage is painted on the vertical caisson from 5 to 18 feet. A standard chain gage was attached to the upstream side of the bridge, near the center of the left span, July 28, 1904. The length of the chain from the end of the weight to the marker is 26.40 feet. It is read once each day by D. T. Rigsby. Discharge measurements are made from the bridge at ordinary stages and by wading above the bridge at extreme low water. The initial point for soundings is the center of the upstream caisson of the left abutment. The channel is straight for 200 feet above and for 400 feet below the station. The current is sluggish at low water. The right bank is high and rocky and will not overflow. The left bank will overflow only at extreme high water. The bed of the stream is composed of sand and gravel, and is liable to shift during freshets. There are two channels at low water and one at high water. The bench mark is the top of the steel caisson, at its outer edge directly above the gage. Its elevation is 18.60 feet above the zero of the gage. The bench mark to which the old station, located at this point, was referred has been destroyed.

The observations at this station during 1904 have been made under the direction of J. T. Whistler, district engineer.

Discharge measurements of Owyhee River near Owyhee, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 13 [a]	J. H. Lewis	318	1,606	3.80	7.00	6,195
March 14 [a]	do	318	1,492	3.50	6.60	5,270
April 18	H. D. Newell	300	1,528	3.80	6.70	5,835
May 10 [b]	Murphy and Sawyer	293	888	2.40	4.85	2,156
June 18 [b]	Torkelson and Sawyer	140	330	1.40	3.20	452
July 2 [b]	M. W. Torkelson	133	214	.64	2.45	136
July 28 [c]	Torkelson and Sawyer	55	34	1.00	2.00	34
September 1 [c]	E. N. Smith	47	59	.27	1.90	16
October 12	do	140	219	.76	2.50	168

[a] No water in ditch. [b] Ditch not included. [c] Wading above station.

Mean daily gage height, in feet, of Owyhee River near Owyhee, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	2.69	6.70	7.90	5.20	4.20	2.40	1.90	1.90	2.05	2.70	2.70
2	2.85	2.64	6.20	6.90	5.10	4.25	2.40	1.85	1.95	2.10	2.65	2.70
3	2.90	2.64	6.00	6.50	5.00	4.20	2.40	1.90	1.90	2.05	2.70	2.75
4	3.00	2.65	5.80	6.40	5.05	4.05	2.40	1.85	1.95	2.10	2.65	2.70
5	3.50	2.68	5.60	6.30	5.10	4.00	2.40	1.80	1.90	2.20	2.70	2.65
6	3.10	2.70	5.60	6.40	5.15	3.95	2.40	1.85	1.95	2.15	2.65	2.60
7	2.90	2.72	6.30	6.45	5.10	3.90	2.45	1.80	1.90	2.20	2.60	2.65

Mean daily gage height, in feet, of Owyhee River near Owyhee, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8	2.75	2.73	6.20	6.20	5.10	3.55	2.40	1.75	1.95	2.30	2.65	3.00
9	2.55	2.75	7.50	6.00	5.00	3.80	2.35	1.70	2.00	2.60	2.70	2.90
10	2.75	2.78	8.20	5.80	4.95	3.75	2.35	1.75	1.95	2.55	2.65	2.85
11	2.90	2.80	8.10	5.70	4.90	3.70	2.35	1.75	2.00	2.60	2.70	2.80
12	3.00	2.81	7.60	5.60	4.95	3.55	2.35	1.70	1.95	2.55	2.65	2.75
13	3.10	2.80	7.20	6.00	4.90	3.50	2.35	1.75	2.00	2.50	2.70	2.70
14	3.05	2.90	7.00	6.30	5.00	3.45	2.25	1.65	2.00	2.55	2.65	2.75
15	2.90	3.00	6.40	6.40	4.90	3.40	2.20	1.70	2.05	2.50	2.70	2.70
16	2.82	6.50	6.20	6.50	4.80	3.35	2.25	1.65	2.00	2.55	2.65	2.70
17	2.75	6.00	6.00	6.70	4.70	3.30	2.15	1.60	2.05	2.50	2.65	2.75
18	2.85	5.00	6.10	6.60	4.00	3.25	2.20	1.60	2.00	2.55	2.70	2.70
19	2.50	6.00	6.40	6.50	4.70	3.10	2.15	1.65	2.05	2.60	2.65	2.75
20	2.40	5.30	7.30	6.40	4.60	3.75	2.20	1.70	2.10	2.70	2.70	2.70
21	2.50	6.00	8.00	6.50	4.55	3.20	2.15	1.65	2.15	2.65	2.65	2.70
22	2.70	6.50	7.80	6.40	4.50	2.90	2.10	1.70	2.10	2.70	2.70	2.75
23	2.80	6.77	7.40	6.30	4.45	2.80	2.10	1.75	2.05	2.65	2.70	2.70
24	2.85	12.20	6.50	6.20	4.40	2.78	2.05	1.70	2.00	2.70	2.65	2.75
25	2.86	9.60	6.40	6.10	4.35	2.70	2.00	1.75	2.05	2.65	2.70	2.70
26	2.88	9.40	6.00	6.00	4.30	2.65	2.05	1.70	2.10	2.70	2.70	2.65
27	2.92	8.60	5.80	5.90	4.35	2.60	2.00	1.75	2.15	2.65	2.70	2.70
28	2.85	8.10	6.20	5.60	4.30	2.55	2.05	1.70	2.10	2.70	2.65	2.75
29	2.80	7.65	7.50	5.40	4.25	2.50	2.00	1.75	2.05	2.65	2.70	2.70
30	2.75	.....	7.90	5.30	4.20	2.45	1.95	1.80	2.10	2.70	2.65	2.75
31	2.70	.....	9.00	.....	4.15	.....	2.00	1.75	.....	2.65	.....	3.00

Rating table for Owyhee River near Owyhee, Oreg., from August 28, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	4	3.20	495	4.80	2,070	6.80	5,880
1.70	6	3.30	555	4.90	2,220	7.00	6,360
1.80	9	3.40	620	5.00	2,380	7.20	6,840
1.90	16	3.50	685	5.10	2,540	7.40	7,330
2.00	30	3.60	755	5.20	2,700	7.60	7,840
2.10	50	3.70	830	5.30	2,860	7.80	8,360
2.20	72	3.80	910	5.40	3,020	8.00	8,900
2.30	96	3.90	1,000	5.50	3,190	8.20	9,440
2.40	123	4.00	1,095	5.60	3,370	8.40	9,990
2.50	155	4.10	1,195	5.70	3,550	8.60	10,550
2.60	190	4.20	1,300	5.80	3,740	8.80	11,110
2.70	230	4.30	1,410	5.90	3,930	9.00	11,670
2.80	275	4.40	1,525	6.00	4,130	9.50	13,070
2.90	325	4.50	1,650	6.20	4,540	10.00	14,520
3.00	380	4.60	1,780	6.40	4,970	11.00	17,420
3.10	435	4.70	1,920	6.60	5,420	12.00	20,320

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.80 feet and 7.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Owyhee River near Owyhee, Oreg., for 1903 and 1904.

[Drainage area, 9,875 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1903.						
September	44	13	27.6	1,642	0.0028	0.0031
October	118	42	97.5	5,995	.0099	.011
November	495	118	338.	20,110	.034	.038
December	408	205	283.	17,400	.029	.033
1904.						
January	685	123	302	18,570	.031	.036
February	20,920	206	3,955	227,500	.401	.432
March	11,670	3,370	6,012	369,700	.609	.702
April	8,630	2,860	4,680	278,500	.474	.529
May	2,700	1,248	1,998	122,900	.202	.233
June	1,355	139	664	39,510	.067	.075
July	139	23	800	4,919	.0081	.0093
August	16	4	7.8	482	.00079	.00091
September	61	16	34.1	2,029	.0035	.0039
October	230	40	162	9,961	.016	.018
November	230	190	219	13,030	.022	.025
December	380	190	250	15,370	.025	.029
The year	20,920	4	1,530	1,102,000	.155	2.09

To obtain the total discharge of the river above the Owyhee ditch division the following monthly discharges of the ditch should be added:

Estimated monthly discharge of Owyhee ditch near Owhee, Oreg., for 1904.

Month.	Total in acre-feet.	Month.	Total in acre-feet.
May	6,926	August	9,104
June	9,726	September	7,571
July	11,054	October 1–20	2,271

BOISE RIVER NEAR BOISE, IDAHO.

The station, established December 15, 1894, is located about 9 miles above Boise, Idaho, at the mouth of the canyon. The original gage was in two sections. The lower part is of 2 by 6 inch plank,

inclined and marked from 1 foot to 7.5 feet; the upper part is a 4 by 4 inch timber, placed vertically, and marked from 7.5 to 12 feet, both portions painted white. The bench mark is a bridge spike driven into a cottonwood tree 20 feet from gage and 20 feet from river. It is 3.40 feet above the 8-foot mark on the gage. Measurements are made from a cable just below the gage.

In the latter part of July, 1895, it was decided to locate a secondary gage on Boise River to obtain the slope of the water surface. This was placed 425 feet below the old gage and carefully connected by means of a level. Both were referred to the same datum. At that time the lower end of the old gage was found to be warped and was corrected. A gage was also placed on the lower Boise in order to determine the water going by at the lowest stage during the irrigating season. The meter can generally be used by wading, but in high water measurements can be made from a wagon bridge.

April 18, 1897, the river cut into the right bank of the station, carrying out the cable and leaving the gage on a small island, so that the record after that date is unreliable. A temporary gage was therefore established May 12 at the Broadway Bridge, at Boise, and a record kept by it until June 17, when a new gage, which is now used, was again placed in the canyon 1 mile above the old location. The inclined rod is firmly attached to a cottonwood tree. The bench mark is a 20-penny spike in the upstream face of the 6 by 8 inch cable support, about 2 feet above the ground. Its elevation is 15.00 feet above datum. Two spikes in same post are 14.00 feet above datum. Discharge measurements are made from a cable and car 50 feet below the gage. An auxiliary cable for flood measurements is placed 117 feet above the main cable. The initial point for soundings is the face of the cable support on the right bank. At ordinary stages the channel is straight, both above and below the station. The banks are high and not liable to overflow. About 300 feet below the cable is a gravel bar, reducing the width of the river at low water to about one-third of the channel and forcing the entire flow against the south bank. The channel is liable to change during extreme high floods. During 1900 the New York Canal Company built a wing dam of timber and loose rock, headed about 150 feet below the station and extending from the north bank diagonally down and across the stream a distance of about 50 feet, in order to protect the north bank from erosion. The construction of this wing dam did not seem to interfere with the flow of the river at the station. During the year 1902 new cable supports were set and bench marks were carefully verified.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Discharge measurements of Boise River near Boise, Idaho, in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 7	F. S. Stockton	300	1,930	6.53	5.95	12,600
June 8	Stockton and Bond	295	1,660	6.08	5.10	10,090
June 28	do	288	1,224	4.44	3.56	5,433
July 16	do	284	796	3.48	2.10	2,772
August 11	do	270	396	2.90	.70	1,188
October 7	do	270	353	2.62	.40	1,003

Mean daily gage height, in feet, of Boise River near Boise, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	0.6		2.5	2.9	5.2	5.7	3.7	1.05	0.3	0.4
2			2.1	2.9	5.2	5.7	3.6	1.0	.05	.35
3			2.1	3.1	5.6	5.3	3.6	1.0	.05	.2
4		0.85	1.95	3.5	6.0	5.0	3.6	1.0	.05	.12
5			1.95	3.7	5.8	5.0	3.2	.95	.05	.2
6			1.95	3.8	5.85	5.2	3.2	1.1	.05	.3
7			2.5	3.7	5.8	5.1	3.2	1.05	−.4	.4
8			4.6	3.75	5.7	5.1	3.2	1.1	−.4	.4
9			5.6	4.1	5.7	5.05	3.2	1.1	−.4	.45
10			4.1	5.3	5.85	5.0	2.9	.65	−.4	.5
11			3.5	5.6	5.85	5.0	2.7	.65	.3	.5
12		.88	3.3	6.25	6.0	4.8	2.5	.6	.3	.5
13			3.1	6.75	6.0	4.6	2.4	.6	.3	.45
14			2.9	7.4	6.1	4.7	2.3	.6	.3	.4
15	.9		2.8	7.85	6.2	4.8	2.2	.58	.3	.4
16			2.6	7.35	6.2	5.2	2.1	.55	.3	.6
17		3.0	2.7	7.0	6.2	5.4	1.9	.58	.3	.6
18			2.8	6.7	6.3	5.3	1.9	.55	.2	.6
19			3.3	7.2	6.3	5.2	1.85	.58	.25	.65
20			3.2	7.4	6.6	4.85	1.8	.55	.2	.5
21			3.05	6.7	7.0	4.7	1.8	.65	.3	.5
22			2.85	5.8	7.4	4.6	1.8	.65	.2	.42
23			2.8	5.2	7.6	4.4	1.85	.65	.3	.4
24		2.5	2.6	4.9	7.4	4.0	1.7	.3	.3	.4
25	.9		2.55	4.9	6.9	3.8	1.6	.3	.3	.4
26			2.4	5.5	6.55	3.6	1.4	.2	.3	.4
27			2.45	6.2	5.8	3.6	1.3	.12	.4	.45
28			2.3	5.7	5.8	3.6	1.3	.12	.4	.4
29			3.2	5.5	6.0	3.7	1.3	.12	.4	.4
30			3.2	5.35	5.6	3.7	1.2	.4	.4	.4
31			2.9		5.7		1.1	.4		.4

Rating table for Boise River near Boise, Idaho, from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−0.40	280	1.40	1,920	3.20	4,680	5.00	9,440
− .30	350	1.50	2,030	3.30	4,890	5.10	9,770
− .20	425	1.60	2,140	3.40	5,100	5.20	10,110
− .10	500	1.70	2,260	3.50	5,320	5.30	10,450
.00	580	1.80	2,380	3.60	5,540	5.40	10,790
.10	665	1.90	2,500	3.70	5,770	5.60	11,470
.20	750	2.00	2,630	3.80	6,010	5.80	12,150
.30	840	2.10	2,760	3.90	6,250	6.00	12,830
.40	930	2.20	2,900	4.00	6,500	6.20	13,550
.50	1,020	2.30	3,050	4.10	6,760	6.40	14,270
.60	1,115	2.40	3,210	4.20	7,020	6.60	14,990
.70	1,210	2.50	3,370	4.30	7,300	6.80	15,710
.80	1,305	2.60	3,540	4.40	7,580	7.00	16,450
.90	1,400	2.70	3,720	4.50	7,880	7.20	17,210
1.00	1,500	2.80	3,900	4.60	8,180	7.40	17,970
1.10	1,600	2.90	4,090	4.70	8,480	7.60	18,730
1.20	1,705	3.00	4,280	4.80	8,800	7.80	19,490
1.30	1,810	3.10	4,480	4.90	9,120		

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1904. It is fairly well defined between gage heights 0.50 foot and 6.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Boise River near Boise, Idaho, for 1904.

[Drainage area, 2,614 square miles.[a]]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
March	11,470	2,565	4,260	261,900	1.63	1.88
April	19,680	4,090	11,200	666,400	4.28	4.78
May	18,730	10,110	13,360	821,500	5.11	5.89
June	11,810	5,540	8,689	517,000	3.32	3.70
July	5,770	1,600	3,257	200,300	1.25	1.44
August	1,600	682	1,156	71,080	.442	.510
September	930	280	730	43,440	.279	.311
October	1,163	682	951	58,480	.364	.420
The period				2,640,000		

[a] Drainage area revised since 1903 report.

MALHEUR RIVER NEAR WESTFALL, OREG.

This station was established December 15, 1903, by John H. Lewis. It is located 3 miles below the Harper ranch, near Westfall, 22 miles above Vale, Oreg. A plain staff gage, graduated to feet and tenths, was attached vertically to a frame bent of a bridge which formerly occupied this site, on the left bank. An inclined gage, graduated to read direct to feet and tenths, was established on the right bank 50 feet above the cable July 27, 1904. The slope is 2 inclined to 1 vertical. The gage is read gratuitously once each day by Lewis Scott, Superintendent Pacific Live Stock Company. Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The initial point for soundings is the zero of the tagged wire, and is 20.6 feet from the lower end of the turn-buckle. The channel is straight for about 1,000 feet above and 200 feet below the station, and the current is swift. The right bank is low, covered with sage brush, and overflows during high water. The left bank is high, rocky, and not liable to overflow. The bed of the stream is composed of gravel and sand, free from vegetation, and is shifting. There is but one channel at low water, and one main channel and two sloughs at high stages. Bench mark No. 1 is the head of a drift bolt projecting from the top surface at the east end of the frame bent to which the gage is attached. Its elevation is 17.64 feet above the zero of the gage. Bench mark No. 2 is the top of a stake on the left bank near the gage and 75 feet from the river bank. Its elevation is 23.14 feet above the zero of the gage. Bench mark No. 3 is the top of a stake on the right bank, directly in line with the cable and 185 feet from the deadman. Its elevation is 18.50 feet above the zero of the gage.

The bench mark for the inclined gage is a nail in the top of a 3 by 6 inch post to which the stay wire is fastened. Its elevation is 15.92 feet above the zero of the gage. As the inclined gage is referred to a new datum, this bench mark supersedes the others.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Malheur River near Westfall, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 8	J. H. Lewis	201	1,330	6.20	11.10	8,300
March 9	do	201	1,456	6.30	11.65	9,150
March 10	do	199	1,009	5.10	9.50	5,160
April 7	Lewis and Newell	198	688	4.31	8.65	2,965
April 13	H. D. Newell	201	896	5.90	9.70	5,290
May 18	J. M. Griffin	195	455	3.77	7.30	1,716
May 25	do	195	439	3.76	7.30	1,652
June 17	Sawyer and Torkelson	190	186	2.40	6.18	446
July 21[a]	M. W. Torkelson	40	58	2.50	5.50	145
August 25[a]	Sawyer and Smith	23	19	2.32	5.25	44
October 23[a]	E. N. Smith	39	46	3.20	5.63	147

[a] Made at different section.

Mean daily gage height, in feet, of Malheur River near Westfall, Oreg., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	7.80	8.90	6.60	5.70	5.40	5.20	5.50	5.60
2	.....	8.00	8.60	6.50	5.70	5.40	5.20	5.50	5.60
3	.....	8.20	8.50	6.50	5.70	5.40	5.20	5.50	5.60
4	.....	8.70	8.30	6.40	5.70	5.35	5.20	5.50	5.60
5	.....	8.80	8.30	6.40	5.70	5.35	5.20	5.50	5.60
6	.....	8.60	8.20	6.30	5.70	5.30	5.30	5.50	5.60
7	.....	8.70	8.00	6.30	5.70	5.30	5.20	5.50	5.60
8	11.01	8.30	7.70	6.30	5.70	5.30	5.20	5.55	5.60
9	11.70	8.30	7.80	6.30	5.70	5.30	5.20	5.55	5.60
10	9.40	8.80	7.80	6.30	5.80	5.25	5.20	5.62	5.60
11	8.60	9.10	7.80	6.30	5.80	5.25	5.20	5.60	5.60
12	8.20	9.50	7.80	6.20	5.80	5.25	5.30	5.60	5.60
13	7.80	9.70	7.60	6.20	6.30	5.25	5.30	5.60	5.60
14	7.80	10.20	7.50	6.20	5.70	5.30	5.30	5.62	5.60
15	7.80	10.50	7.50	6.20	5.70	5.30	5.30	5.62	5.60
16	8.30	10.50	7.40	6.20	5.60	5.30	5.30	5.60	5.60
17	8.40	10.20	7.40	6.20	5.60	5.25	5.30	5.60	5.60
18	8.70	10.00	7.30	6.10	5.60	5.25	5.40	5.62	5.70
19	8.70	9.70	7.30	6.10	5.60	5.25	5.40	5.60	5.70
20	8.70	10.70	7.30	6.10	5.60	5.25	5.40	5.60	5.70
21	8.50	10.60	7.30	6.10	5.60	5.25	5.40	5.60	.....
22	8.40	10.60	7.10	6.10	5.50	5.25	5.40	5.60	.....
23	7.30	9.80	7.10	6.00	5.50	5.25	5.40	5.60	.....
24	7.00	9.80	7.20	6.00	5.50	5.25	5.40	5.60	.....
25	6.80	9.50	7.30	5.90	5.50	5.25	5.40	5.60	.....
26	6.70	8.20	7.20	5.80	5.50	5.25	5.55	5.60	.....
27	6.70	9.70	7.10	5.80	5.50	5.30	5.55	5.60	.....
28	6.70	9.20	7.00	5.80	5.50	5.30	5.50	5.60	.....
29	9.10	9.40	6.90	5.80	5.50	5.25	5.50	5.60	.....
30	9.00	9.00	6.80	5.70	5.40	5.25	5.50	5.60	.....
31	8.30	.....	6.70	.....	5.40	5.20	.....	5.60	.....

Rating table for Malheur River near Westfall, Oreg., from March 8 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
5.30	64	6.80	893	8.20	2,513	10.20	6,288
5.40	104	6.90	982	8.30	2,668	10.40	6,696
5.50	146	7.00	1,075	8.40	2,827	10.60	7,104
5.60	188	7.10	1,172	8.50	2,990	10.80	7,512
5.70	230	7.20	1,273	8.60	3,160	11.00	7,920
5.80	274	7.30	1,378	8.70	3,332	11.20	8,328
5.90	318	7.40	1,487	8.80	3,509	11.40	8,736
6.00	362	7.50	1,600	8.90	3,692	11.60	9,144
6.10	411	7.60	1,717	9.00	3,880	11.80	9,552
6.20	463	7.70	1,838	9.20	4,263	12.00	9,960
6.30	519	7.80	1,963	9.40	4,657	12.50	10,980
6.40	581	7.90	2,092	9.60	5,064	13.00	12,000
6.50	650	8.00	2,225	9.80	5,472	14.00	14,040
6.60	727	8.10	2,365	10.00	5,880	15.00	16,080
6.70	808						

The above table is applicable for open-channel conditions only. It is based upon 11 discharge measurements, made during 1904. It is fairly well defined between 5.25 feet and 11.50 feet gage heights.

Estimated monthly discharge of Malheur River near Westfall, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]			229	14,080
February [a]			3,099	178,300
March [a]	9,348	808	2,767	170,100
April	7,308	1,963	4,617	274,700
May	3,692	808	1,749	107,500
June	727	230	450	26,780
July	519	104	206	12,670
August	104	34	58	3,566
September	167	34	80	4,760
October	196	146	178	10,940
November [a]			216	12,850
December [a]			230	14,140
The period			1,157	830,400

[a] Estimated January, February, March 1 to 7, November 21 to 30, and December 1 to 31.

MALHEUR RIVER AT VALE, OREG.

This station was established as a temporary station May 20, 1903, by N. S. Dils. The permanent station was established June 30, 1903. It is located at the steel highway bridge one-eighth mile southeast of Vale, Oreg. The lower section of the original gage was an inclined 2 by 6 inch timber under the downstream edge of the bridge, near the left pier. It read from 0 to 14 feet. This section being destroyed by flood February 16, 1904, it was replaced February 25, 1904, by a vertical section nailed to a vertical post 12 feet downstream from caisson at the left abutment of the bridge. The upper section, reading from 14 to 20 feet, was painted on the downstream side of the downstream caisson of the left abutment. A standard chain gage was attached to the downstream side of the bridge near the center of the span July 25, 1904. The length of the chain from the end of the weight to the marker is 30.41 feet.

During 1904 the gage was read twice each day by E. R. Murray and J. A. Newton. Discharge measurements were originally made from the upstream side of the bridge at which the gage is located. On March 2, 1904, a cable, car, and tagged and stay wire were installed about one-fourth mile downstream from the gage and directly opposite the town of Vale. The initial point for soundings is the zero of the tagged wire, on the left bank, 28.7 feet from the lower end of the turn-buckle. The channel is straight for about 200 feet above and 300 feet below the station, and the current is swift. The right bank is high, rocky, free from vegetation, and does not overflow. The left bank is low, composed of firm earth, covered with small sagebrush, and liable to overflow at high water, at which times the water flows in two sloughs on the left bank, which can be measured by wading. The bed of the stream is composed of gravel and sand, free from vegetation, and is liable to shift. There is but one channel at all stages, with the exception of the above-mentioned sloughs. A station has been maintained here at intervals since 1890. The bench mark is the top surface of the east steel caisson at the north end of the bridge. Its elevation is 21.63 feet above the zero of the gage and 2,236.56 feet above sea level.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Malheur River at Vale, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 11	J. H. Lewis	156	968	4.85	8.28	4,695
April 5	Lewis and Newell	159	862	4.95	8.42	4,269
April 12	H. D. Newell	162	1,090	5.63	9.33	6,136
April 16	do	.....	1,265	6.26	10.22	7,912
April 24	J. M. Griffin	158	1,050	5.60	8.75	5,670
May 9	Murphy and Sawyer	150	697	3.38	6.82	2,310
June 15	J. M. Griffin	115	312	1.78	5.10	556
June 16	Sawyer and Torkelson	106	290	1.48	4.98	430
July 11	M. W. Torkelson	105	217	1.00	4.40	214
July 20	do	100	185	.60	4.00	107
August 6 [a]	Smith and Torkelson	44	44	1.05	3.75	47
September 24	E. N. Smith	45	46	1.24	3.78	57
October 10 [b]	do	.....	73	1.03	4.08	75

[a] Wading above station. [b] Floats.

Mean daily gage height, in feet, of Malheur River at Vale, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.20	4.80	7.00	7.70	8.20	5.65	4.20	3.78	3.75	3.90	4.20	4.35
2	4.00	4.75	7.00	7.40	7.95	5.60	4.20	3.80	3.70	3.90	4.20	4.32
3	4.10	4.50	6.68	8.70	7.80	5.60	4.20	3.80	3.70	3.90	4.20	4.25
4	4.20	4.25	6.45	8.30	7.60	5.60	4.20	3.70	3.70	3.90	4.20	4.10
5	4.20	4.20	6.90	8.55	7.45	5.60	4.20	3.80	3.70	3.92	4.20	4.28
6	4.15	4.20	7.50	8.50	7.35	5.50	4.10	3.75	3.70	3.95	4.25	4.10
7	4.25	4.20	9.10	8.25	7.10	5.50	4.10	3.70	3.70	4.00	4.25	4.20
8	4.35	4.10	10.55	8.08	6.95	5.50	4.70	3.70	3.70	4.40	4.25	4.28
9	4.50	4.00	10.90	8.00	6.80	5.40	4.45	3.70	3.70	4.10	4.25	4.25
10	4.35	4.20	9.50	8.04	6.80	5.40	4.20	3.80	3.70	4.10	4.25	4.20
11	4.30	4.40	8.10	8.07	6.70	5.30	4.30	3.80	3.70	4.10	4.30	4.25
12	4.30	4.55	7.70	9.03	6.70	5.30	4.40	3.80	3.70	4.10	4.25	4.35
13	4.30	4.50	7.10	9.06	6.65	5.20	4.40	3.80	3.70	4.20	4.25	4.35
14	4.30	4.30	6.95	9.08	6.60	5.15	4.35	3.80	3.70	4.20	4.25	4.40
15	4.35	4.45	7.05	10.02	6.50	5.10	4.20	3.80	3.70	4.20	4.25	4.35
16	4.45	10.15	7.15	10.02	6.50	5.00	4.20	3.80	3.70	4.20	4.25	4.10
17	4.60	8.75	6.95	9.90	6.45	4.90	4.20	3.80	3.70	4.20	4.25	4.40
18	4.65	8.55	7.65	9.55	6.40	4.80	4.15	3.80	3.70	4.30	4.30	4.40
19	4.60	7.10	8.05	9.30	6.35	4.80	4.10	3.80	3.70	4.30	4.30	4.40
20	4.50	6.45	8.40	10.10	6.30	4.75	4.00	3.80	3.70	4.20	4.30	4.40
21	4.40	6.00	8.28	10.55	6.20	4.70	4.00	3.80	3.70	4.20	4.30	4.35
22	4.45	13.60	7.20	10.90	6.10	4.70	4.00	3.80	3.75	4.20	4.30	4.20
23	4.55	10.20	7.05	9.70	6.10	4.70	4.00	3.75	3.75	4.25	4.30	4.25
24	4.60	11.10	6.70	9.05	6.15	4.60	4.00	3.75	3.80	4.20	4.35	4.35
25	4.60	13.70	6.38	8.70	6.20	4.60	3.90	3.75	3.85	4.20	4.35	4.20
26	4.80	9.85	6.20	8.45	6.20	4.55	3.95	3.75	3.90	4.20	4.38	4.30
27	4.80	8.15	6.22	8.15	6.05	4.50	3.92	3.75	4.00	4.20	4.40	4.30
28	4.70	7.40	6.40	8.35	6.00	4.40	3.90	3.80	3.95	4.22	4.40	4.40
29	4.65	6.90	7.60	8.50	5.95	4.40	3.88	3.80	3.90	4.20	4.40	4.25
30	4.60	.....	8.45	8.35	5.80	4.30	3.82	3.75	3.90	4.20	4.40	4.25
31	4.75	.....	8.30	.....	5.70	.....	3.82	3.75	.....	4.20	.....	4.75

Rating table for Malheur River at Vale, Oreg., from March 11 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.70	40	5.20	595	6.60	1,921	9.00	5,700
3.80	57	5.30	660	6.70	2,046	9.20	6,076
3.90	81	5.40	729	6.80	2,176	9.40	6,452
4.00	107	5.50	800	6.90	2,311	9.60	6,828
4.10	133	5.60	877	7.00	2,450	9.80	7,204
4.20	159	5.70	958	7.20	2,732	10.00	7,580
4.30	186	5.80	1,044	7.40	3,021	10.50	8,520
4.40	215	5.90	1,138	7.60	3,321	11.00	9,460
4.50	250	6.00	1,240	7.80	3,630	11.50	10,400
4.60	288	6.10	1,345	8.00	3,950	12.00	11,340
4.70	329	6.20	1,454	8.20	4,280	12.50	12,280
4.80	371	6.30	1,566	8.40	4,624	13.00	13,220
4.90	419	6.40	1,681	8.60	4,976	13.50	14,160
5.00	475	6.50	1,800	8.80	5,334	14.00	15,100
5.10	534						

The above table is applicable for open-channel conditions. It is based upon 20 discharge measurements made during 1903 and 1904. It is fairly well defined between gage heights, 3.70 feet and 9.30 feet. The table has been extended above 9.30 feet.

Estimated monthly discharge of Malheur River at Vale, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]	371	107	236	14,510
February [a]	14,540	107	3,105	178,600
March [a]	9,272	1,454	3,461	212,800
April	9,272	3,021	5,524	328,700
May	4,280	958	2,027	124,600
June	917	186	533	31,720
July	329	61	146	8,977
August	57	40	52.1	3,203
September	107	40	50.4	2,999
October	215	81	144	8,854
November	215	159	182	10,830
December	350	133	188	11,560
The year	14,540	40	1,304	937,400

[a] January 1 to March 10, inclusive, estimated

MALHEUR RIVER AT M'LAUGHLIN'S BRIDGE, NEAR VALE, OREG.

This station was established December 10, 1904, by W. C. Sawyer. It is located at the new county bridge, known as McLaughlin's bridge, 10 miles above Vale, Oreg. A standard chain gage is attached to the upstream hand rail of the bridge, near the left bank. The length of the chain from the end of the weight to the marker is 21.72 feet. The gage is read weekly during ordinary, and daily during flood stages by R. N. Linebarger. Discharge measurements are made from the iron bridge to which the gage is fastened, consisting of two spans and wooden approaches.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

MALHEUR RIVER AT HALLIDAY'S BRIDGE, NEAR ONTARIO, OREG.

This station was established December 8, 1904, by W. C. Sawyer. It is located at the county bridge, known as Halliday's bridge, which is 10 miles above Ontario, Oreg. A standard chain gage is attached to the upstream handrail of the bridge near the right bank. The length of the chain from the end of the weight to the marker is 23.70 feet. The gage is read daily by T. W. Halliday. The measurements are made from the upstream side of the bridge. The channel is straight for about one-fourth mile above the station and 800 feet below. The right bank is clean, high, and does not overflow. The left bank is clean and high, but overflows at very high water. The bed of the stream is sandy, clean, and shifting. There is one channel at all stages. The initial point for soundings is 20 feet from the truss pin of the upstream truss on the right bank. Bench mark No. 1 is the south end of the bedplate which supports the south end of the upstream truss. Its elevation is 18.99 feet above datum of the gage and 2,201.40 feet above sea level. Bench mark No. 2 is the north end of the bedplate which supports the north end of the upstream truss. Its elevation is 18.89 feet above datum of the gage. A temporary bench mark is the top of the upstream end of the first floor beam from the right bank, 38.5 feet from the initial point for soundings. Its elevation is 19.27 feet above the datum of the gage. This station was established as a temporary one to assure records in case other stations on Malheur River and Willow Creek should be damaged by floods.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Malheur River at Halliday's bridge, near Ontario, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 23	J. H. Lewis	130	1,073	7.8	12.2	8,370
December 7	W. C. Sawyer	28	48	1.6	2.05	76

Mean daily gage height, in feet, of Malheur River, at Halliday's bridge near Ontario, Oreg., for 1904.

Day.	Dec.	Day.	Dec.	Day.	Dec.	Day.	Dec.
8	2.5	14	2.5	20	2.6	26	2.1
9	2.5	15	2.5	21	2.5	27	2.15
10	2.3	16	2.3	22	2.4	28	2.3
11	2.25	17	2.4	23	2.4	29	2.25
12	2.4	18	2.9	24	2.5	30	2.4
13	2.45	19	2.7	25	2.4	31	3.0

MALHEUR RIVER NEAR ONTARIO, OREG.

This station was established December 8, 1903, by John H. Lewis. It is located at the new county bridge about 2½ miles northwest of Ontario, Oreg., and about 1¼ miles above the junction of the Malheur with Snake River. Brosnan ditch takes water from the river on the left bank 3 miles above the station, and the Nevada ditch, on the right bank 12 miles above. Both conduct some water past the station at certain times. The gage is in two sections. The lower, graduated to read direct to feet and tenths from 2 to 10 feet, is fastened in an inclined position to the left bank just above the bridge. The gage is continued on a vertical staff to 21 feet. The gage was read twice each day by William O'Brien. Discharge measurements were made from the single-span highway bridge. The initial point for soundings is the left end of the upstream railing of the bridge over the pier. Five-foot intervals are marked on the railing with 10-penny nails. The channel is straight for about 150 feet above and 200 feet below the station and the current is sluggish. Both banks are low, covered with brush, and liable to overflow during extreme high water. The bed of the stream is composed of sand and gravel, free from vegetation, and may shift slightly during floods. There is one channel at low, and several at high water, flowing in sloughs which are measured by wading. Floods in Snake River occur at different times from those in Malheur River, but the water surface at the gage is said to have been unaffected by back water during recent years. Bench mark No. 1

is the edge of the steel band on the upstream bridge caisson at the left bank. Its elevation is 18.90 feet above the zero of the gage. Bench mark No. 2 is a notch cut in the southeast corner of the observer's house. Its elevation is 20.00 feet above the zero of the gage. The bridge was washed away in May, 1904, and the station abandoned.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Malheur River near Ontario, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 22	J. H. Lewis	110	632	5.00	12.10	3,190
February 22	do	115	790	5.40	13.42	4,270
February 22	do	117	890	5.90	14.35	5,270
February 22	do	117	975	6.30	15.08	6,210

Mean daily gage height, in feet, of Malheur River near Ontario, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	6.30	6.90	10.60	11.90	13.70	17	8.50	16.60	11.45	15.35	.....
2	6.30	7.00	10.90	12.50	13.45	18	8.50	11.70	12.15	14.80	.....
3	6.30	6.80	10.68	12.35	13.15	19	7.50	9.60	12.45	14.50	.....
4	6.20	6.90	10.28	12.40	13.00	20	7.20	8.55	13.20	15.25	.....
5	6.70	7.28	10.25	13.20	12.85	21	7.20	8.35	13.20	16.45	.....
6	6.60	7.48	10.60	13.75	12.75	22	7.20	11.65	12.05	16.80	.....
7	6.50	6.51	13.00	13.10	12.85	23	7.30	17.40	11.20	15.40	.....
8	6.50	6.52	15.95	13.70	12.55	24	7.30	16.30	10.70	14.70	.....
9	6.50	7.55	16.75	13.10	12.50	25	7.00	17.45	10.15	14.50	.....
10	6.50	6.32	15.45	13.10	12.45	26	6.90	16.60	10.10	13.65	.....
11	6.70	7.38	13.65	13.55	12.42	27	6.80	14.30	10.30	13.65	.....
12	6.80	7.45	12.60	14.15	12.35	28	6.80	13.65	10.35	13.85	.....
13	7.80	7.50	12.10	14.55	12.18	29	6.70	11.10	11.00	13.20	.....
14	7.80	6.92	11.40	14.95	12.20	30	6.90	.....	13.50	12.70	.....
15	7.80	7.38	11.55	15.35	.....	31	6.90	.....	13.15	.....	.....
16	7.80	12.15	11.65	15.55	.....						

BULLY CREEK ABOVE VALE, OREG.

This station was established August 10, 1903, by John H. Lewis. It was located about one-eighth mile below the mouth of Cottonwood Creek and 13 miles from Vale, Oreg. It was about 2 miles below a proposed reservoir site on this creek. The gage was located on the left bank and consisted of 2 by 6 inch timbers. The lower section was inclined and read from 0 to 6 feet. The upper section is vertical and read from 6 to 12 feet. The gage was about 200

feet from the house of F. O'Neill, who read the gage twice each day. Discharge measurements were made by means of a cable and a car about 70 feet below the gage. The initial point for soundings was the zero on the tagged wire on the left bank, 25 feet from the lower end of the turnbuckle. The main channel at ordinary stages is straight for 200 feet above the cable. At flood stages the right bank overflows above the cable, causing a bend in the channel about 75 feet above. The channel is straight for 800 feet below the station. At the cable the right bank is low, will overflow at extreme flood stages, and is covered with sagebrush. The left bank is low, but is not liable to overflow. The bed of the stream is composed of gravel and sand, free from vegetation, and liable to shift. There is but one channel at all stages. Bench mark No. 1 is a projecting stone on the top of the wall in the front of the observer's house on the west side of the entrance. Its elevation is 16.92 feet above the zero of the gage. Bench mark No. 2 is a 2 by 4 inch timber projecting from the northeast corner of the granary, about 42 feet from the gage. Its elevation is 12.37 feet above the zero of the gage.

Owing to changes in the channel and destruction of the original gage by flood the cable was moved 125 feet downstream February 26 and a new gage installed February 27, 1904. The new gage was a 2 by 6 inch timber supported in a horizontal position above high water and projecting over the water. Readings were made by means of a graduated rod by reading down from the bottom of the 2 by 6 inch timber, which was at 11.30 above zero. This gage was at the same datum as the old gage. The water surface between the new and old gage was practically level for gage height 5.50 feet, being 0.03 foot lower at the new gage than at the old.

The station, as reestablished February 27, 1904, was destroyed by flood and abandoned March 11, 1904, a new channel having been formed several hundred feet from the gage. On the latter date a new station was established on Bully Creek near its mouth, at Vale, Oreg. Except for a few days when surface snow is going off no streams enter Bully Creek between the new and the old station. Five small ditches divert water during the irrigation season.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurement of Bully Creek above Vale, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 27	J. H. Lewis	82	152	3.60	5.50	560

Mean daily gage height, in feet, of Bully Creek above Vale, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	2.60	2.47	5.00	12	2.60	2.61	.....	22	2.60	7.25	.....
2	2.60	2.42	5.35	13	2.60	2.60	.....	23	2.60	6.75	.....
3	2.60	2.45	5.00	14	2.60	2.54	.....	24	2.60	8.50	.....
4	2.60	2.60	5.24	15	2.60	2.71	.....	25	2.60	7.44	.....
5	2.60	2.60	4.70	16	2.60	6.00	.....	26	2.60	6.20	.....
6	2.60	2.54	5.40	17	2.60	3.90	.....	27	2.57	5.62	.....
7	2.60	2.50	7.80	18	2.60	2.75	.....	28	2.50	5.00	.....
8	2.60	2.50	7.70	19	2.60	2.55	.....	29	2.52	5.10	.....
9	2.60	2.50	5.20	20	2.60	2.50	.....	30	2.51	.....	.....
10	2.60	2.50	5.20	21	2.60	2.50	.....	31	2.50	.....	.....
11	2.60	2.55	.....								

BULLY CREEK AT VALE, OREG.

This station was established April 8, 1904, by John H. Lewis. It is located at the county highway bridge across Bully Creek just above its junction with Malheur River at Vale, Oreg. The station is 13 miles below the former station on this creek, which was destroyed by flood and discontinued March 11, 1904. The original gage consisted of a rod graduated to feet and tenths, by means of which the distance of the water surface below the top of a projecting floor beam on the east side of the bridge was measured. A standard chain gage was attached to the bridge October 29, 1904. The length of the chain from the end of the weight to the marker is 17.22 feet. Discharge measurements are made from the downstream side of the single-span bridge. The initial point for soundings is the south end of the east bridge railing. Five-foot intervals are marked along the bridge with black paint. The channel is straight for about 50 feet above and 300 feet below the station and the current is swift. Both banks are high, clear, and not subject to overflow. The bed of the stream is composed of clay and sand and is shifting. There is but one channel at all stages. Bench mark No. 1 is the top surface of the north projecting floor beam on the east side of the bridge. Its elevation is 15.36 feet above the datum of the gage. Bench mark No. 2 is on the north end of stone doorsill at the north door on the west side of old flour mill about 390 feet southeast of the bridge. Its elevation is 18.80 feet above the datum of the gage. Except for a few days when surface snow is going off no streams enter Bully Creek between this and the old station. Five small ditches divert water during the irrigation season. The station is affected by back water and will not be maintained longer than necessary to make a comparison between the results obtained at this station and the former station 13 miles upstream.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Bully Creek at Vale, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 24		.....	268	4.20	7.09	1,120
April 8		.....	181	5.35	7.00	968
April 11		.....	265	5.44	8.40	1,442
April 12		.....	254	5.58	7.50	1,416
April 14	H. D. Newell	50	285	4.90	8.00	1,390
April 16	do	50	269	3.90	7.75	1,050
April 25	J. M. Griffin	45	172	4.06	6.90	698
May 7	do	40	81	2.60	5.76	210
May 9	Murphy and Sawyer	43	79	2.30	5.50	180
June 15	W. C. Sawyer	14	14	1.60	4.10	22
August 26	Smith and Sawyer	15	5	.75	3.78	4
September 24 [a]	E. N. Smith	9	5	.63	3.75	3

[a] Measurement made at different section.

Mean daily gage height, in feet, of Bully Creek at Vale, Oreg., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.60	4.10	4.10	3.90	3.70	3.70	3.75	3.65
2	.....	6.40	4.10	4.10	3.90	3.70	3.70	3.75	3.50
3	.....	6.40	4.10	4.10	3.90	3.70	3.70	3.75	3.45
4	.....	6.20	4.10	4.10	3.90	3.70	3.70	3.75	3.20
5	.....	6.30	4.10	4.10	3.90	3.70	3.70	3.70	3.30
6	.....	5.90	4.10	4.10	3.90	3.70	3.70	3.70	3.20
7	.....	5.70	4.10	4.10	3.90	3.70	3.75	3.70	3.45
8	7.00	5.60	4.10	5.00	3.80	3.70	3.75	3.70	3.70
9	7.02	5.50	4.10	4.40	3.80	3.70	3.75	3.70	3.60
10	7.05	5.40	4.10	4.30	3.80	3.70	3.75	3.70	3.70
11	7.50	5.30	4.10	4.20	3.80	3.70	3.75	3.65	3.70
12	8.00	5.10	4.10	4.30	3.80	3.70	3.75	3.65	3.70
13	8.01	5.00	4.10	4.30	3.80	3.70	3.75	3.65	3.80
14	8.02	5.00	4.10	4.30	3.80	3.70	3.75	3.65	3.80
15	8.04	5.00	4.10	4.20	3.80	3.70	3.75	3.65	4.40
16	8.00	5.00	4.10	4.20	3.80	3.70	3.75	3.65	3.70
17	7.08	5.00	4.10	4.20	3.80	3.70	3.75	3.65	3.60
18	7.04	5.00	4.10	4.20	3.80	3.70	3.75	3.65	4.20
19	7.20	4.90	4.10	4.10	3.80	3.70	3.80	3.65	3.60
20	7.80	4.70	4.10	4.10	3.80	3.70	3.80	3.65	3.70
21	7.85	4.50	4.10	4.10	3.80	3.70	3.80	3.65	3.80
22	7.90	4.40	4.10	4.10	3.70	3.70	3.80	3.65	3.70
23	8.00	4.30	4.10	4.10	3.70	3.70	3.80	3.65	3.80
24	7.50	4.20	4.10	4.00	3.70	3.70	3.70	3.65	3.70
25	7.20	4.10	4.10	4.00	3.70	3.70	.....	3.65	3.80
26	7.00	4.10	4.10	4.00	3.70	3.70	.....	3.65	3.80
27	6.80	4.10	4.10	4.00	3.70	3.70	.....	3.65	3.70
28	6.80	4.10	4.10	4.00	3.70	3.70	.....	3.65	3.70
29	6.70	4.10	4.10	4.00	3.70	3.70	3.70	3.65	3.60
30	6.60	4.10	4.10	3.90	3.70	3.70	3.70	3.65	3.60
31	.....	4.10	.....	3.90	3.70	.....	3.75	.....	3.70

Estimated monthly discharge of Bully Creek at Vale, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]			12.5	769
February [a]			327	18,810
March [a]			725	44,580
April [a]			1,018	60,580
May	547	22	159	9,777
June	22	22	22.0	1,309
July	112	10.5	26.5	1,629
August	10.5	2.1	5.58	343
September	2.1	2.1	2.10	125
October	5.6	2.1	3.17	195
November	3.3	1.2	1.66	99
December	44	.0	4.34	267
The year			192	138,500

[a] From March 11 to April 7, inclusive, the discharge was estimated.

NOTE.—Owing to the shifting character of the bed the above estimates are only approximate.

WILLOW CREEK NEAR MALHEUR, OREG.

This station was established November 4, 1904, by W. C. Sawyer. It is located at Beer's ranch, about 5 miles from Malheur on the road to Huntington, Oreg. A plain staff gage, graduated to feet and tenths, is attached to an immense bowlder at the mouth of the canyon, about one-half mile below the cable. The gage is read once each day by S. P. Colt. Discharge measurements are made by means of a cable and car. The initial point for soundings is the eyebolt to which the cable is attached at the left bank. The channel is straight for 100 feet above and below the station and the current swift. Both banks are high, clean, and do not overflow. The bed of the stream is composed of rock and gravel, free from vegetation, and is permanent. There is but one channel at all stages. Bench mark No. 1 is a square chisel draft, marked with the letters "B. M." in black paint, on the top of the bowlder to which the gage is fastened, 5.4 feet upstream from the gage. Its elevation is 5.74 feet above the zero of the gage. Bench mark No. 2 is a square chisel draft on top of a rock 14 feet upstream from the cable at a point 21 feet from the anchorage of the right end of the cable. Its elevation is assumed at 100.00 feet for reference for cross section at cable.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurement of Willow Creek near Malheur, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
September 20	W. C. Sawyer	6.5	3.9	1.11	0.7	4.3

Mean daily gage height, in feet, of Willow Creek near Malheur, Oreg., for 1904.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.85	11			21	0.85	0.8
2		.75	12			22	.85	.8
3		.85	13			23	.85	
4			14			24	.85	
5		.95	15			25	.8	
6		.95	16		0.8	26	.85	
7		.95	17		.8	27	.85	
8		.9	18		.8	28	.85	
9		.8	19		.8	29	.85	
10		.8	20	0.85	.8	30	.85	

WILLOW CREEK NEAR DELL, OREG.

This station was established May 12, 1904, by H. D. Newell. It is located at a bridge at Cole's ranch near Dell, Oreg., 28 miles above Vale. A plain staff gage was attached to a pole which was driven into the sand and spiked to the bridge. On November 1, 1904, a standard chain gage was attached, at the same datum, to the downstream side of the bridge. The length of the chain from the end of the weight to the marker is 18.06 feet. The gage is read once each day by Emory Cole. Discharge measurements are made from the downstream side of the wooden highway bridge to which the gage is attached. The bridge has a single span of about 137 feet and trestle approach at each end. The initial point for soundings is the left end of the downstream hand rail. The channel is slightly curved for about 200 feet above and straight for 200 feet below the station, somewhat obstructed by willows. The current is moderate. Both banks are low, but all the water passes between the abutments of the bridge. The bed of the stream is composed of mud and is slightly shifting. There is but one channel at all stages, broken by the bridge bents. Bench mark No. 1 is a group of three spikes driven into a post at the corner of the fence about 40 feet east of the initial point. Its elevation is 14.92 feet above the zero of the gage. Bench mark No. 2 is a cross painted on the top of stone of east abutment 6.5 feet from the initial point and marked "B. M." Its elevation is 14.79 feet above the zero of the gage. Bench mark No. 3 is the top of a bolt at the foot of the inclined end post of the south truss of the bridge, 20 feet from the initial point for soundings. Its elevation is 14.97 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Willow Creek near Dell, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 14	H. D. Newell	80	340	2.80	7.06	940
April 15	do	57	328	2.70	6.86	880
April 23	J. M. Griffin	53	175	2.32	5.46	412
May 12	do	52	84	2.23	4.21	187
June 20	Sawyer and Torkelson	35	15	1.20	2.52	18
July 8 [a]	M. W. Torkelson	14	3	1.30	2.29	4
September 3 [a]	E. N. Smith	4	1.5	.99	2.00	1.5
November 1 [b]	W. C. Sawyer	14	8.3	1.34	2.26	11

[a] Floats. [b] Wading.

Mean daily gage height, in feet, of Willow Creek near Dell, Oreg., for 1904.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.06	3.30	2.55	1.90	1.90	2.15	2.40	2.30
2		5.06	3.30	2.60	1.90	1.90	2.10	2.45	2.30
3		4.89	3.28	2.67	1.90	1.90	2.15	2.45	2.30
4		4.73	3.23	2.65	1.90	1.90	2.15	2.45	2.30
5		4.48	3.20	2.30	1.90	1.90	2.20	2.45	2.30
6		4.40	3.10	2.60	1.90	1.90	2.20	2.42	2.30
7		4.27	3.05	2.30	1.90	1.90	2.25	2.40	2.35
8		4.23	2.97	2.35	1.90	1.90	2.25	2.40	2.40
9		4.23	2.95	2.40	1.90	1.90	2.30	2.40	2.40
10		4.14	2.97	2.30	1.90	1.90	2.30	2.35	2.40
11			2.90	2.35	1.90	1.90	2.35	2.35	2.40
12		4.21	2.90	2.35	1.90	2.00	2.30	2.35	2.40
13		4.20	2.95	2.35	1.90	2.00	2.40	2.35	2.40
14	7.06	4.22	2.80	2.35	1.90	2.00	2.30	2.30	2.40
15	6.86	4.19	2.70	2.30	1.90	2.00	2.40	2.30	2.35
16		4.00	2.67	2.15	1.90	2.10	2.40	2.30	2.35
17		4.00	2.49	2.15	1.90	2.10	2.40	2.30	2.35
18		3.97	2.48	2.10	1.90	2.10	2.40	2.30	2.40
19		3.95	2.47	2.05	1.90	2.10	2.40	2.30	2.40
20		3.92	2.48	2.05	1.90	2.10	2.45	2.30	2.40
21		3.85	2.48	2.00	1.90	2.10	2.45	2.30	2.40
22		3.80	2.48	2.00	1.90	2.10	2.45	2.30	2.40
23	5.46	3.80	2.50	2.00	1.90	2.10	2.45	2.30	2.45
24		3.75	2.50	1.97	1.90	2.10	2.45	2.35	2.45
25		3.62	2.50	1.90	1.90	2.10	2.45	2.35	2.45
26	4.81	3.54	2.51	1.90	1.90	2.10	2.45	2.30	2.50
27	4.73	3.50	2.51	1.90	1.90	2.10	2.45	2.30	2.50
28	4.56	3.48	2.51	1.95	1.90	2.10	2.45	2.30	2.60
29	5.06	3.40	2.50	1.92	1.90	2.15	2.45	2.30	2.65
30	4.98	3.35	2.50	1.90	1.90	2.15	2.40	2.30	2.70
31		3.30		1.90	1.90		2.40		2.75

Rating table for Willow Creek near Dell, Oreg., from April 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.90	0.5	3.20	59	4.50	226	6.60	776
2.00	1.5	3.30	68	4.60	244	6.80	852
2.10	3	3.40	78	4.70	262	7.00	930
2.20	5	3.50	88	4.80	280	7.20	1,010
2.30	7	3.60	98	4.90	300	7.40	1,090
2.40	11	3.70	110	5.00	320	7.60	1,170
2.50	15	3.80	122	5.20	362	7.80	1,250
2.60	20	3.90	134	5.40	408	8.00	1,330
2.70	26	4.00	148	5.60	456	8.50	1,530
2.80	32	4.10	162	5.80	511	9.00	1,730
2.90	38	4.20	177	6.00	570	9.50	1,930
3.00	44	4.30	193	6.20	636	10.00	2,130
3.10	51	4.40	209	6.40	704		

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1904. It is well defined between gage heights 2.00 feet and 7.10 feet. The table has been extended beyond these limits. Above gage height 6.90 feet the rating curve is a tangent, the difference being 40 per tenth.

Estimated monthly discharge of Willow Creek near Dell, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January [a]			10.0	615
February [a]			221	12,710
March [a]			783	48,140
April [a]			624	37,130
May	332	68	163	10,020
June	68	14	31.7	1,886
July	24	.5	6.87	422
August	.5	.5	.50	31
September	4	.5	1.95	116
October	13	3	9.42	579
November	13	7	8.90	530
December	29	7	12.2	750
The year			156	112,900

[a] Estimated.

WEISER RIVER NEAR WEISER, IDAHO.

The drainage basin of this river is mountainous and rocky, in contrast to the well-wooded areas of the Boise and Payette basins, and the effect is shown in the high flood discharges and low summer flow. A number of small ditches utilize considerable water from this river, but the principal canal is the Galloway canal, which irrigates lands of the Weiser irrigation district north of Weiser. Above this canal is a bench country susceptible of cultivation if water could be brought to it.

The station was established December 6, 1894, by A. P. Davis. It is located on J. W. Lane's ranch in the canyon of the river about 10 miles above Weiser, Idaho. The gage rod, which was installed in 1898, was covered during the process of grading for the roadbed of the Pacific and Idaho Northern Railroad, a line intended to run from Weiser to the mining country in the mountainous district to the north. The present gage was installed October 31, 1899, at a point 100 feet above the old gage on the right bank. It is a 4 by 4 inch inclined timber, 12 feet long, bolted to the rock bluff. One foot measured vertically equals 1.15 feet measured along the gage. The gage is read once each day by Mrs. Annie T. Lane. Discharge measurements are made from a cable and car about 300 feet downstream from the gage. The initial point for soundings is 10 feet from the cable support on the right bank. The channel is straight for 300 feet above and below the station. The current is sluggish. The right bank is high and rocky and is not liable to overflow. The left bank is low and will overflow for 100 feet. Both banks are without trees, but brush grows on that part of the left bank liable to overflow. There is but one channel at all stages. The bed of the stream is composed of gravel, free from vegetation, and not liable to change. Bench mark No. 1 is the highest point of a rock 40 feet southwest of the south anchorage of the cable. Its elevation is 19.54 feet above the zero of the gage. Bench mark No. 2 is the highest point of a rock 60 feet southwest of the cable anchorage on the right bank. Its elevation is 25.16 feet above the zero of the gage. This station was discontinued December 31, 1904.

The observations at this station during 1904 have been made under the direction of D. W. Ross, district engineer.

Mean daily gage height, in feet, of Weiser River near Weiser, Idaho, for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	2.1	4.8	5.5	4.7	4.4	2.2	0.7	0.5	0.4	0.7	0.6
2	1.2	2.1	6.25	5.4	4.6	4.4	2.3	.6	.5	.6	.7	.6
3	1.2	2.1	6.15	5.4	5.0	4.4	2.2	.6	.5	.6	.7	.6
4	1.2	2.1	4.4	5.8	4.9	4.4	2.2	.6	.5	.6	.7	.6
5	1.2	2.1	4.0	5.5	4.7	4.3	2.1	.6	.5	.5	.7	.6
6	1.2	2.1	5.1	5.5	4.7	4.3	2.0	.7	.5	.6	.7	.6
7	1.2	2.1	8.0	5.5	4.7	4.0	1.9	.7	.5	.4	.7	.6
8	1.0	2.1	10.5	5.0	4.7	4.0	1.9	.6	.4	.6	.7	.6
9	1.0	2.1	9.9	5.0	4.8	4.0	1.9	.5	.4	.8	.7	.6
10	1.2	2.1	7.95	5.25	4.6	4.0	1.8	.5	.3	.8	.7	.6
11	1.2	2.1	8.9	6.1	4.6	3.8	1.7	.5	.3	.9	.7	.6
12	1.2	2.1	7.0	6.55	4.6	3.5	1.7	.5	.3	.9	.7	.6
13	1.2	2.1	5.8	7.0	4.6	3.3	1.7	.4	.3	.8	.7	.6
14	1.2	2.1	5.6	7.35	4.6	3.3	1.6	.5	.3	.8	.7	.6
15	1.2	2.1	6.5	7.55	4.7	3.3	1.5	.5	.3	.8	.7	.6
16	1.2	2.5	5.7	7.8	4.7	3.4	1.5	.5	.3	.8	.7	.6
17	1.3	6.65	7.0	7.5	4.7	3.5	1.5	.5	.3	.8	.7	.7
18	1.4	5.45	6.45	6.8	4.7	3.6	1.4	.5	.3	.8	.7	.7
19	1.6	5.2	9.0	6.7	4.7	3.5	1.3	.4	.3	.8	.7	.7
20	1.6	4.0	8.4	6.85	4.9	3.2	1.2	.4	.3	.8	.7	.7
21	1.7	4.0	6.0	7.0	5.05	3.2	1.2	.4	.3	.8	.7	.7
22	1.8	4.0	5.6	6.1	5.5	3.0	1.1	.4	.3	.8	.7	.7
23	2.0	4.4	5.0	5.5	5.5	3.0	1.0	.4	.3	.8	.7	.7
24	2.0	5.8	4.5	5.0	5.5	2.9	1.0	.4	.3	.7	.7	.7
25	2.2	5.7	4.4	4.7	5.4	2.7	1.0	.4	.3	.7	.7	.8
26	2.2	7.3	4.4	4.7	4.9	2.5	.9	.4	.3	.7	.7	.8
27	2.2	6.4	4.0	5.15	4.5	2.5	.8	.3	.3	.7	.7	.8
28	2.2	5.4	4.35	5.65	4.5	2.4	.8	.5	.3	.7	.7	.8
29	2.2	4.9	7.2	5.3	4.4	2.4	.7	.6	.3	.7	.7	.8
30	2.1	.....	7.5	5.0	4.4	2.3	.7	.8	.3	.7	.7	.8
31	2.1	.....	6.0	.....	4.4	.....	.7	.6	.....	.7	.....	.8

Rating table for Weiser River near Weiser, Idaho, from January 1, 1902, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	39	2.2	875	4.2	3,125	6.2	5,825
.4	71	2.4	1,050	4.4	3,395	6.4	6,095
.6	105	2.6	1,235	4.6	3,665	6.6	6,365
.8	150	2.8	1,425	4.8	3,935	6.8	6,635
1.0	215	3.0	1,625	5.0	4,205	7.0	6,900
1.2	290	3.2	1,840	5.2	4,475	7.5	7,575
1.4	375	3.4	2,075	5.4	4,745	8.0	8,250
1.6	470	3.6	2,325	5.6	5,015	8.5	8,925
1.8	585	3.8	2,585	5.8	5,285	9.0	9,600
2.0	720	4.0	2,855	6.0	5,555	9.5	10,275

The above table is applicable for open-channel conditions only. It is based upon discharge measurement made during 1902 and 1903, and is fairly well defined.

Estimated monthly discharge of Weiser River near Weiser, Idaho, for 1904.

[Drainage area, 1,670 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	875	215	473	29,080	0.283	0.326
February	7,305	798	2,532	145,600	1.52	1.64
March	11,620	2,855	6,004	369,200	3.60	4.15
April	7,980	3,800	5,467	325,300	3.27	3.65
May	4,880	3,395	3,911	240,500	2.34	2.70
June	3,395	962	2,204	131,100	1.32	1.47
July	962	127	453	27,850	.271	.312
August	150	55	91.6	5,632	.055	.063
September	88	55	63.8	3,796	.038	.042
October	182	71	132	8,116	.079	.091
November	127	127	127	7,557	.076	.085
December	150	105	121	7,440	.072	.083
The year	11,620	55	1,798	1,301,000	1.08	14.61

POWDER RIVER NEAR BAKER CITY, OREG.

This station was established December 20, 1903, by John H. Lewis. It is located 10 miles above Baker City, Oreg., and one-fourth mile below Salisbury, a station on the Sumpter Valley Railroad. A plain staff gage, graduated to feet and tenths, is nailed in a vertical position to a tree on the left bank, about 400 feet below the house of R. M. Garrett, who reads the gage twice each day. Discharge measurements are made from a wagon bridge having a single span of about 50 feet. The initial point for soundings is at the left end of the bridge. Five-foot intervals are marked on the bridge by means of 20-penny nails. The channel is straight for about 75 feet above and 100 feet below the station, and the current is swift. Both banks are low, timbered, and liable to overflow. The bed of the stream is composed of gravel, free from vegetation, and is permanent. There is but one channel at all stages. The bench mark is a group of three 30-penny nails driven into a large cottonwood tree which stands on the left bank of the stream 35 feet below the gage and 6 feet above the end of the bridge. Its elevation is 8.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Powder River near Baker City, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 16	J. H. Lewis	39	53	3.10	2.95	162
May 7	W. C. Sawyer	40	110	5.20	4.30	572
May 11	Murphy and Sawyer	40	118	5.60	4.56	660
July 2	W. C. Sawyer	38	50	2.69	2.92	133
September 22 [a]	do	16	8.4	.94	1.74	7.9
December 6 [b]	do	9	10	1.84	2.15	18.4

[a] Wading. [b] Channel partly frozen.

Mean daily gage height, in feet, of Powder River near Baker City, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.24	2.40	2.75	3.15	4.45	4.45	2.95	2.25	2.15	1.80	2.15	2.10
2	2.24	2.45	2.70	3.20	4.55	4.30	2.95	2.20	2.05	1.75	2.15	2.05
3	2.24	2.44	2.80	3.35	4.45	4.40	2.90	2.20	2.05	1.80	2.15	2.00
4	2.24	2.45	2.40	3.60	4.60	4.35	2.80	2.20	2.00	1.85	2.10	1.95
5	2.24	2.42	2.48	3.45	4.55	4.30	2.90	2.15	2.00	1.85	2.15	1.90
6	2.24	2.45	2.75	4.35	4.45	4.50	2.75	2.10	1.95	1.80	2.10	2.15
7	2.24	2.48	3.40	4.35	4.40	4.50	2.85	2.15	1.95	1.85	2.10	2.20
8	2.24	2.40	3.20	4.80	4.45	4.25	2.85	2.15	1.95	1.75	2.05	2.15
9	2.24	2.52	2.95	5.30	4.35	4.35	2.90	2.15	1.90	1.80	2.00	2.20
10	2.24	2.62	3.05	5.40	4.45	4.10	2.75	2.10	1.90	1.90	2.00	2.15
11	2.24	2.58	3.00	6.15	4.55	3.95	2.70	2.05	1.90	2.15	2.05	1.95
12	2.24	2.68	2.90	6.90	4.55	3.75	2.65	2.10	1.85	2.25	2.05	1.95
13	2.24	2.78	2.85	6.45	4.60	3.80	2.60	2.10	1.90	2.20	2.00	2.00
14	2.24	2.65	4.20	7.30	4.50	3.80	2.60	2.05	1.85	2.15	2.00	2.05
15	2.24	2.75	3.05	7.10	4.50	3.85	2.55	2.05	1.85	2.15	2.00	2.15
16	2.24	3.00	2.90	6.35	4.60	3.95	2.50	2.00	1.70	2.15	2.05	2.05
17	2.24	2.92	3.20	5.85	4.65	3.90	2.45	1.85	1.70	2.15	2.00	2.05
18	2.24	3.00	2.90	5.70	4.70	3.80	2.50	1.85	1.65	2.25	2.00	2.15
19	2.24	2.95	2.70	5.65	4.45	3.80	2.40	1.70	1.45	2.35	2.05	2.15
20	2.24	3.10	3.10	6.20	4.45	3.65	2.35	1.75	1.30	2.30	2.05	2.10
21	2.24	3.15	2.85	5.40	4.70	3.50	2.40	1.75	1.85	2.25	2.05	2.10
22	2.24	3.50	2.80	4.30	5.15	3.40	2.35	1.75	1.80	2.30	2.10	2.10
23	2.24	3.15	3.40	4.85	5.40	3.25	2.30	2.15	1.90	2.15	2.10	2.10
24	2.40	3.35	2.85	4.55	4.55	3.25	2.35	2.05	2.00	2.15	2.10	2.15
25	2.34	3.20	2.75	4.35	4.65	3.10	2.30	2.10	2.00	2.15	2.15	2.05
26	2.36	3.17	2.70	4.57	4.55	3.05	2.30	2.15	2.10	2.15	2.15	1.95
27	2.40	3.25	2.50	4.70	4.45	3.05	2.35	2.15	2.05	2.20	2.10	2.00
28	2.39	2.95	2.60	5.10	4.50	2.90	2.25	2.20	2.00	2.20	2.10	2.00
29	2.35	2.95	3.00	5.55	4.50	2.80	2.25	2.20	2.00	2.10	2.10	2.00
30	2.42	.....	2.95	4.90	4.50	2.95	2.30	2.20	1.95	2.15	2.10	2.05
31	2.42	.....	2.95	.....	4.50	.....	2.25	2.30	.....	2.15	.....	2.15

Rating table for Powder River near Baker City, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.60	4	2.90	140	4.20	537	5.80	1,082
1.70	7	3.00	161	4.30	571	6.00	1,150
1.80	11	3.10	184	4.40	605	6.20	1,218
1.90	16	3.20	209	4.50	639	6.40	1,286
2.00	22	3.30	237	4.60	673	6.60	1,354
2.10	30	3.40	267	4.70	707	6.80	1,422
2.20	38	3.50	299	4.80	741	7.00	1,490
2.30	48	3.60	333	4.90	775	7.20	1,558
2.40	60	3.70	367	5.00	810	7.40	1,626
2.50	72	3.80	401	5.20	878	7.60	1,694
2.60	86	3.90	435	5.40	946	7.80	1,762
2.70	102	4.00	469	5.60	1,014	8.00	1,830
2.80	120	4.10	503				

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1903 and 1904. It is fairly well defined between gage heights 1.70 feet and 4.60 feet. The table has been extended beyond these limits. Above gage height 3.50 feet the rating curve is a tangent, the difference being 34 per tenth.

Estimated monthly discharge of Powder River near Baker City, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	62	42	46.2	2,841
February	299	60	133	7,650
March	537	60	154	9,469
April	1,592	196	843	50,160
May	946	588	663	40,770
June	639	120	398	23,680
July	150	43	85.0	5,226
August	48	7	28.8	1,771
September	34	2	17.2	1,024
October	54	9	29.5	1,814
November	34	22	28.0	1,666
December	38	16	27.6	1,697
The year	1,592	2	204	147,800

GRANDE RONDE RIVER AT HILGARD, OREG.

This station was established November 6, 1903, by John H. Lewis. It is located at the county highway bridge one-half mile below the Oregon Railroad and Navigation Company station at Hilgard, Oreg. It is just below the mouth of Five Points Creek, which is the first important tributary above Grande Ronde Valley. There are two dams about 20 miles upstream, used to flood the river during the log-driving season. The gage is a 1 by 4 inch board nailed to a vertical 4 by 6 inch timber, which is driven into the ground at the downstream end of the middle bridge pier and bolted at the upper end to the log pier. J. D. Casey and Jay Hawes read the gage once each day at ordinary stages and twice during floods. Discharge measurements are made from the downstream side of the two-span bridge to which the gage is attached. The bridge is supported by two timber crib abutments and by one middle crib pier. The initial point for soundings is at the point where the end post meets the lower chord of the bridge on the right bank. It is directly over the vertical outer edge of the abutment. The channel is straight for 100 feet above and for 200 feet below the station. At ordinary stages all the water passes under the right span, which has a length of 70 feet from the right abutment to the middle pier. At high water the water also passes under the shorter span, which has a length of 52 feet from the left abutment to the middle pier. The right bank is low, but is not liable to overflow. The left bank is low and will overflow only at a few points above the bridge. The bed of the stream is composed of sand and clay, free from vegetation and bowlders. It is permanent under the main span, but is liable to shift in the high-water channel under the shorter span. Bench mark No. 1 is the head of a bolt through the lower chord of the bridge 7.5 feet from the timber to which the gage is attached. Its elevation is 13.80 feet above the zero of the gage. Bench mark No. 2, established July 15, 1904, is a square chisel draft and the letters "U. S. B. M." cut in the top of a rock 200 feet from the right bank, 150 feet upstream from the bridge. Its elevation is 12.81 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Grande Ronde River at Hilgard, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 6	W. C. Sawyer	125	457	4.86	5.60	2,223
July 15	do	66	202	.36	2.92	72
July 15	do	67	223	.80	3.25	179
July 23	do	67	200	.39	3.00	79
November 5[a]	do	42	60	.52	2.72	31

[a] Made at bridge 1 mile below.

Mean daily gage height, in feet, of Grande Ronde River at Hilgard, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.50	2.70	3.00	4.50	5.60	4.20	3.30					2.80
2	2.50	2.70	2.70	4.80	5.40	4.30	3.30					2.90
3	2.50	2.90	2.90	5.30	5.30	4.20	3.30					2.68
4	2.50	2.80	2.90	5.30	5.20	4.20	3.30					2.50
5	2.50	2.80	3.00	5.20	4.90	4.20	3.30					2.50
6	2.50	2.80	3.20	5.30	5.00	4.20	3.30					3.30
7	2.50	2.70	3.90	5.40	4.80	4.20	3.30					2.80
8	2.50	2.70	5.30	5.40	5.60	4.20	3.30					2.90
9	2.50	2.80	4.60	6.00	4.90	4.10	3.30				2.80	2.75
10	2.50	2.80	4.20	6.50	4.80	4.10	3.30				3.00	2.80
11	2.60	2.80	3.90	6.80	4.90	4.00	3.30				2.80	2.75
12	2.50	2.80	3.80	7.20	4.60	3.90	3.30				2.72	2.72
13	2.50	2.70	3.70	7.40	4.50	3.90	3.30				2.65	2.75
14	2.50	2.80	3.60	7.50	4.60	3.80	3.30				2.70	2.90
15	2.50	2.90	3.90	7.40	4.80	3.70	3.20				2.70	2.80
16	2.50	2.90	3.80	7.00	4.80	3.70	3.20				2.70	2.80
17	2.40	2.90	4.00	6.80	4.70	3.60					2.70	2.80
18	2.40	2.90	4.20	6.70	4.80	3.50					2.70	2.90
19	2.40	2.90	4.60	6.60	4.70	3.50					2.65	2.85
20	2.40	2.90	4.30	6.30	4.70	3.40					2.65	2.90
21	2.50	3.00	3.90	6.00	4.80	3.30					2.62	2.85
22	2.50	3.30	3.70	5.80	4.80	3.30					2.95	2.85
23	2.50	3.50	3.60	5.70	4.70	3.30					2.68	2.82
24	2.60	3.40	3.50	5.60	4.70	3.30					2.62	2.78
25	2.60	3.30	3.40	5.60	4.60	3.30					2.98	2.85
26	2.60	3.20	3.30	5.70	4.40	3.30					2.68	2.75
27	2.60	4.00	3.20	5.90	4.30	3.30					2.62	2.75
28	2.60	2.90	3.60	6.00	4.20	3.30					2.62	2.80
29	2.60	3.00	4.00	5.90	4.30	3.30					2.95	2.85
30	2.60		4.60	5.80	4.30	3.30					2.80	3.00
31	2.60		4.00		4.30							3.25

Rating table for Grande Ronde River at Hilgard, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.50	14	3.70	386	4.80	1,275	5.90	2,592
2.60	19	3.80	444	4.90	1,384	6.00	2,717
2.70	28	3.90	507	5.00	1,495	6.20	2,969
2.80	39	4.00	574	5.10	1,608	6.40	3,221
2.90	57	4.10	645	5.20	1,725	6.60	3,473
3.00	83	4.20	720	5.30	1,846	6.80	3,725
3.10	116	4.30	799	5.40	1,968	7.00	3,977
3.20	153	4.40	883	5.50	2,092	7.20	4,229
3.30	194	4.50	974	5.60	2,216	7.40	4,481
3.40	238	4.60	1,069	5.70	2,341	7.60	4,733
3.50	284	4.70	1,170	5.80	2,466	7.80	4,985
3.60	333						

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is well defined between gage heights 2.70 feet and 3.30 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Grande Ronde River at Hilgard, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	19	12	15.2	935
February	574	28	93.5	5,378
March	1,846	28	485	29,820
April	4,607	974	2,786	165,800
May	2,216	720	1,270	78,090
June	799	194	434	25,820
July 1–16	194	153	189	5,998
November 9–30	83	21	35.9	1,566
December	194	14	50.6	3,111
The period				316,500

GRANDE RONDE RIVER AT ELGIN, OREG.

This station was established November 20, 1903, by John H. Lewis. It is located at the county bridge on the road from Elgin to Wallowa, Oreg., and is one-fourth mile east of the railroad station. It is at

the lower end of the Grande Ronde Valley. The lower section of the original gage, reading from zero to 2 feet, was a 2 by 4 inch rod driven into the mud on the upstream side of the vertical steel caisson of the left pier. From 2 to 9 feet the gage was painted on the side of the caisson. On July 21, 1904, a standard chain gage was attached to the upstream side of the bridge, near the center of the stream. The length of the chain from the end of the weight to the marker is 22.00 feet. It is read once each day by John Graham. Discharge measurements are made from the downstream side of the bridge, to which the gage is attached. This bridge has a span between piers of 100 feet, with 130 feet of trestle approach from the left bank and 30 feet of approach from the right bank. The initial point for soundings is on the right bank directly over the center of the bent, 30 feet from the caisson. The channel is curved above a point 30 feet above the bridge, and is straight for 200 feet below. The right bank is high, rocky, free from vegetation, and will not overflow. The left bank is low, free from vegetation, and will overflow only under the trestle approach. The bed of the stream is uneven, covered with large bowlders, and is free from vegetation. It is not liable to shift. The channel is broken by the piers and the trestle bents at high water. The bench mark is the top surface of the steel caisson directly over the gage. Its elevation is 15.14 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Grande Ronde River at Elgin, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 12	Murphy and Sawyer	160	550	6.30	4.87	3,460
July 22	W. C. Sawyer	89	244	0.85	2.03	209
August 22	do	77	183	0.27	1.48	50
August 22 [a]	do	36	28	2.11	1.48	58
September 28	do	79	214	.52	1.76	111

[a] Made ¼ mile below.

Mean daily gage height, in feet, of Grande Ronde River at Elgin, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.80	2.10	3.20	4.40	5.50	4.20	2.50	1.65	1.50	1.70	1.70	.....
2	1.90	2.00	3.20	4.40	5.40	4.30	2.40	1.65	1.50	1.70	1.70	1.75
3	1.80	2.00	3.00	4.50	5.30	4.30	2.40	1.65	1.55	1.70	1.70	1.75
4	1.90	2.10	3.00	4.50	5.20	4.30	2.40	1.65	1.55	1.60	1.70	1.70
5	1.90	2.20	3.00	4.80	5.20	4.20	2.40	1.65	1.55	1.60	1.70	1.70
6	1.90	2.20	3.40	5.00	5.10	4.10	2.30	1.60	1.55	1.60	1.70	1.85
7	1.90	2.20	3.50	5.00	5.10	4.20	2.30	1.60	1.55	1.60	1.75	1.75

Mean daily gage height, in feet, of Grande Ronde River at Elgin, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8	1.90	2.10	4.90	5.00	5.00	4.10	2.40	1.60	1.50	1.60	1.75	1.75
9	1.80	2.00	4.80	5.20	4.90	4.10	2.50	1.60	1.50	1.65	1.70	1.65
10	1.70	1.90	4.80	5.70	4.90	4.10	2.50	1.60	1.50	1.75	1.70	1.70
11	1.90	1.80	4.80	6.20	4.90	4.00	2.50	1.60	1.55	1.80	1.70	1.70
12	1.90	1.90	4.60	6.50	4.90	3.90	2.50	1.60	1.45	1.80	1.80	1.70
13	1.90	1.90	4.40	6.80	4.90	3.80	2.40	1.55	1.45	1.80	.....	1.75
14	2.00	2.10	4.20	7.00	4.90	3.70	2.40	1.55	1.50	1.85	1.70	1.80
15	2.10	2.20	4.10	7.60	4.90	3.70	2.40	1.55	1.50	1.85	1.70	1.80
16	2.20	3.00	4.10	7.60	4.90	3.60	2.30	1.50	1.50	1.85	1.80	1.70
17	2.40	3.00	4.10	7.60	4.80	3.60	2.30	1.50	1.50	1.90	1.75	1.70
18	2.20	2.90	4.10	7.60	4.80	3.60	2.20	1.50	1.50	2.00	1.70	1.75
19	2.10	2.70	4.20	7.60	4.80	3.60	2.10	1.50	1.45	1.90	1.70	1.80
20	2.10	2.70	4.30	7.20	4.80	3.50	2.00	1.50	1.45	1.80	1.75	1.80
21	1.80	2.70	4.40	7.00	4.80	3.40	2.00	1.45	1.45	1.75	1.75	1.80
22	2.10	2.70	4.30	6.80	4.80	3.20	2.00	1.45	1.45	1.75	1.75	1.75
23	2.20	3.20	4.10	6.60	4.80	3.10	2.00	1.45	1.50	1.75	1.70	1.75
24	2.10	3.70	3.90	6.20	4.80	3.00	1.95	1.45	1.50	1.80	1.75	1.80
25	2.00	3.50	3.80	5.90	4.80	2.90	1.90	1.45	1.55	1.80	1.70	1.80
26	2.20	3.50	3.60	5.80	4.80	2.80	1.85	1.45	1.65	1.75	1.75	[a] 1.60
27	2.30	3.50	3.40	5.70	4.70	2.80	1.80	1.45	1.65	1.75	1.75	[a] 1.70
28	2.20	3.20	3.50	5.60	4.60	2.80	1.75	1.50	1.80	1.75	1.75	[a] 1.85
29	2.20	3.10	3.70	5.60	4.40	2.70	1.80	1.55	1.80	1.70	1.75	[a] 1.85
30	2.20	.....	4.30	5.60	4.20	2.60	1.75	1.55	1.80	1.70	1.75	[a] 1.70
31	2.20	.....	4.50	.....	4.20	.....	1.70	1.55	.....	1.70	.....	[a] 1.80

[a] Gage heights December 26 to 31, inclusive, are approximate, owing to ice.

Rating table for Grande Ronde River at Elgin, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.50	53	2.80	589	4.10	2,114	5.80	5,127
1.60	74	2.90	663	4.20	2,277	6.00	5,485
1.70	99	3.00	743	4.30	2,446	6.20	5,843
1.80	128	3.10	829	4.40	2,621	6.40	6,201
1.90	158	3.20	923	4.50	2,800	6.60	6,559
2.00	190	3.30	1,025	4.60	2,979	6.80	6,917
2.10	225	3.40	1,135	4.70	3,158	7.00	7,275
2.20	264	3.50	1,253	4.80	3,337	7.20	7,633
2.30	307	3.60	1,379	4.90	3,516	7.40	7,991
2.40	354	3.70	1,513	5.00	3,695	7.60	8,349
2.50	405	3.80	1,655	5.20	4,053	7.80	8,707
2.60	462	3.90	1,804	5.40	4,411	8.00	9,065
2.70	523	4.00	1,957	5.60	4,769		

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is not well defined. Above gage height 4.40 feet the rating curve is a tangent, the difference being 179 per tenth.

Estimated monthly discharge of Grande Ronde River at Elgin, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	354	99	204	12,540
February	1,513	128	528	30,370
March	3,516	743	2,007	123,400
April	8,349	2,621	5,525	328,800
May	4,590	2,277	3,471	213,400
June	2,446	462	1,496	89,020
July	405	99	271	16,660
August	86	44	63.1	3,880
September	128	44	63.2	3,760
October	190	74	114	7,010
November	128	99	107	6,367
December	143	74	114	7,010
The year	8,349	44	1,168	842,200

GRANDE RONDE RIVER AT ZINDEL, WASH.

This station was established June 30, 1904, by W. G. Steward. It is located at Zindel Ferry, 2 miles above the mouth of the river and 1½ miles below Joseph Creek. The gage is located just below the ferry on the left bank. It is an inclined fir log, hewed flat on the top face and graduated to vertical feet and tenths, from 2.5 to 8.9 feet. The gage is read daily by M. W. Zindel, who is paid by the Lewiston Water and Power Company. Discharge measurements are made from the ferryboat. The distances are measured on the stay-line used for the ferry. The initial point is an 8-penny nail in a pine tree 30 feet south of the cable post on the right bank. The channel is curved above the station, but straight for 1,200 feet below. There are rapids 600 feet above and also 1,200 feet below the station. The right bank is rocky and slopes gradually. It is liable to overflow at extreme high water. The left bank is high and rocky, and not liable to overflow. The bed is rocky and permanent. It is fairly even for soundings. There is one channel at all stages. The bench mark is located 29 feet downstream from the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Grande Ronde River at Zindel, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
June 29	W. G. Steward	208	1,182	3.18	4.32	3,762
August 11	C. M. Hulburt	192	801	1.40	2.58	1,118

Mean daily gage height, in feet, of Grande Ronde River at Zindel, Wash., for 1904.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.00	2.90	2.40	2.30	2.30	2.30
2		5.00	2.85	2.35	2.30	2.30	2.25
3		4.65	2.80	2.35	2.30	2.30	2.25
4		4.70	2.75	2.30	2.25	2.30	2.15
5		4.65	2.70	2.30	2.20	2.25	2.15
6		4.60	2.70	2.29	2.25	2.25	2.15
7		4.60	2.70	2.28	2.30	2.25	2.25
8		4.55	2.63	2.25	2.30	2.25	2.30
9		4.45	2.65	2.23	2.35	2.25	2.40
10		4.40	2.60	2.21	2.35	2.25	2.30
11		4.30	2.00	2.20	2.35	2.25	2.25
12		4.25	2.00	2.20	2.35	2.30	2.25
13		4.20	2.55	2.20	2.40	2.30	2.30
14		4.05	2.55	2.20	2.45	2.25	2.30
15		3.90	2.50	2.20	2.60	2.25	2.35
16		4.00	2.50	2.20	2.50	2.25	2.40
17		3.90	2.50	2.20	2.50	2.25	2.35
18		3.90	2.50	2.20	2.45	2.25	2.35
19		3.80	2.50	2.20	2.45	2.25	2.35
20		3.60	2.50	2.20	2.45	2.25	2.30
21		3.55	2.40	2.20	2.45	2.30	2.30
22		3.60	2.40	2.20	2.40	2.30	2.40
23		3.55	2.35	2.20	2.40	2.30	2.50
24		3.50	2.30	2.20	2.40	2.25	2.15
25		3.50	2.30	2.20	2.40	2.25	2.30
26		3.40	2.30	2.35	2.35	2.25	2.20
27		3.25	2.30	2.40	2.35	2.30	2.20
28		3.30	2.30	2.30	2.30	2.30	2.25
29	4.32	3.30	2.45	2.30	2.30	2.30	2.30
30	4.18	3.10	2.50	2.30	2.30	2.30	2.60
31		3.00	2.50	.....	2.30	.....	2.65

WALLOWA RIVER NEAR JOSEPH, OREG.

This station was established November 12, 1903, by John H. Lewis. The gage is located on Wallowa Lake near its outlet. It is a vertical 2 by 6 inch board fastened to a log pier which extends into the lake. It reads from zero to 5 feet. It is read once each day by F. L. Bedingfield. Discharge measurements are made from a footbridge about 500 feet below the outlet of Wallowa Lake and 1¼ miles above Joseph, Oreg. The bridge has a single span of 50 feet. The initial point for soundings is the end of the upstream log supporting the footbridge on the left bank. The channel is straight for 100 feet above and for 75 feet below the station. The right bank is liable to overflow at high water for about 30 feet, at which point it becomes steep. The left bank will overflow for about 20 feet at high water. Both banks are timbered.

At the bridge the bed of the stream is composed of large bowlders, free from vegetation, and is not liable to shift. There is but one channel at all stages. The direction of the wind is liable to affect both the gage readings on the lake and the discharge. The bench mark is a square chisel draft and the letters "U. S. G. S. B. M." painted in black on a granite bowlder on the beach, under a large cottonwood tree, about 65 feet northwest of the gage. Its elevation is 4.95 feet.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Wallowa River near Joseph, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 18	W. C. Sawyer	40	102	3.94	2.98	402
July 18[a]	do	60	194	2.13	2.97	413
August 18	do	35	67	3.50	2.38	234
September 26	do	31	36	2.30	1.53	84
September 26[a]	do	75	78	1.21	1.54	95

[a] At footbridge.

Mean daily gage height, in feet, of Wallowa River near Joseph, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.45	1.10	.....	1.40	2.00	3.20	3.80	2.70	.....	1.50	.....	1.30
2	1.45	1.20	.....	1.45	2.00	3.20	3.80	2.70	.....	1.50	1.40	1.30
3	.....	.....	.....	1.35	2.00	3.20	3.95	2.60	.....	1.50	1.40	1.30
4	.....	1.25	.....	1.33	2.00	3.20	3.95	2.60	.....	1.50	1.40	1.30
5	.....	1.25	.....	1.30	2.00	3.20	3.90	.....	.....	1.50	1.40	1.30
6	.....	.....	.....	1.30	2.00	3.25	3.90	.....	.....	1.50	1.40	1.30
7	.....	1.20	.....	1.30	2.00	3.25	3.90	.....	.....	1.50	.....	1.30
8	.....	1.20	1.45	1.30	2.00	3.25	3.85	.....	.....	1.50	1.30	1.30
9	.....	1.20	1.45	1.30	2.00	3.30	3.80	.....	.....	1.60	1.30	1.30
10	1.42	.....	.....	1.33	2.00	3.30	3.80	.....	.....	.....	1.30	1.30
11	1.42	.....	.....	1.37	2.07	3.30	3.75	.....	.....	1.40	1.30	1.30
12	1.40	1.25	.....	1.40	2.10	.....	3.70	.....	.....	1.60	1.30	1.30
13	1.40	1.25	.....	1.45	2.15	.....	3.65	.....	.....	1.60	1.30	.....
14	1.40	1.25	1.50	1.52	2.20	.....	3.50	.....	.....	1.60	.....	.....
15	1.40	1.25	1.40	1.70	2.25	3.30	3.45	.....	.....	1.60	1.30	1.30
16	1.40	1.35	1.40	1.80	2.30	3.40	.....	.....	.....	1.60	1.30	1.30
17	.....	1.35	1.40	1.85	2.38	3.50	3.10	2.38	.....	1.60	.....	1.30
18	.....	1.40	1.40	1.90	2.50	3.60	3.00	2.40	.....	1.60	1.30	1.30
19	.....	1.45	1.45	1.95	2.58	3.70	2.90	.....	.....	1.50	1.30	1.30
20	.....	1.45	1.45	2.00	2.60	3.80	2.80	.....	.....	1.50	.....	1.20
21	.....	1.40	.....	2.00	2.65	3.80	2.85	.....	.....	1.50	.....	1.30
22	.....	1.40	.....	2.00	2.75	3.80	2.80	.....	.....	1.50	1.30	1.30
23	.....	1.40	1.45	2.00	2.90	3.70	2.95	.....	.....	1.50	1.30	.....
24	1.40	1.40	1.45	2.00	3.05	3.60	3.00	.....	.....	1.50	1.30	1.30
25	1.35	1.40	1.40	1.95	3.10	3.55	3.10	.....	1.54	1.50	1.30	1.30
26	1.35	1.35	1.40	1.95	3.10	3.50	3.50	.....	1.53	1.40	1.30	1.30
27	1.30	.....	1.45	.....	3.05	3.50	3.00	.....	.....	1.40	1.30	1.20
28	1.25	.....	1.40	1.95	.....	3.55	3.00	.....	1.50	1.40	.....	1.20
29	1.25	.....	1.50	1.95	3.05	3.65	2.95	.....	1.60	1.40	1.30	.....
30	1.25	.....	1.50	1.95	3.05	3.70	2.90	.....	1.50	.....	.....	1.40
31	1.25	.....	1.45	.....	3.15	.....	2.80	.....	.....	1.40	.....	1.40

Rating table for Wallowa River near Joseph, Oreg., from November 13, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.20	53	2.00	157	2.70	315	3.40	541
1.30	63	2.10	175	2.80	344	3.50	575
1.40	73	2.20	195	2.90	374	3.60	609
1.50	85	2.30	216	3.00	406	3.70	643
1.60	97	2.40	238	3.10	439	3.80	677
1.70	110	2.50	262	3.20	473	3.90	711
1.80	125	2.60	283	3.30	507	4.00	745
1.90	141						

The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.50 feet and 3.00 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Wallowa River near Joseph, Oreg., for 1903 and 1904.

Month.	Discharge in second-feet.[a]			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
November 13–30	103	85	94.2	3,363
December	97	77	86.0	5,288
1904.				
January	79	58	72.0	4,427
February	79	45	63.1	3,630
March	85	73	78.0	4,796
April	157	63	110	6,545
May	456	157	266	16,360
June	677	473	555	33,020
July	728	344	534	32,830
August	315	185	240	14,760
September	185	85	133	7,914
October	97	73	85.4	5,251
November	73	63	65.3	3,889
December	73	53	62.7	3,855
The year	728	45	189	137,300

[a] Discharge interpolated for missing gage heights.

WALLOWA RIVER NEAR WALLOWA, OREG.

This station was established November 14, 1903, by John H. Lewis. It is located at the county bridge, 1½ miles below Wallowa, Oreg., and one-fourth mile below the mouth of Bear Creek. A small irrigation

ditch which carries about 2 second-feet takes water from the river about 300 feet above the bridge on the right bank. The gage is a vertical 2 by 6 inch timber nailed to the downstream side of the timber crib pier on the right bank. Its location is such that it is protected by the pier from drift. It is read once each day by L. S. Johnson. Discharge measurements are made from the upstream side of the bridge to which the gage is attached. The initial point for soundings is the left end of the lower chord on the upstream side of the bridge. The channel is straight for 400 feet above and for 600 feet below the station. The current is swift. Both banks are low, wooded, and not liable to overflow. The bed of the stream is composed of gravel, free from vegetation, and is not liable to shift. There is but one channel at low water. At high water the channel is broken by the rock-filled timber crib pier, to which the gage is fastened. Bench mark No. 1 is the head of a 30-penny wire nail driven nearly flush with the top of the crib, 2 inches from the edge, near the gage. Its elevation is 6.60 feet above the zero of the gage. Bench mark No. 2 is a square chisel draft on top of a rock near rail fence across the ditch 50 feet from the right end of the bridge. Its elevation is 8.10 feet above the gage zero.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Wallowa River near Wallowa, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 19	W. C. Sawyer	88	200	5.30	3.09	1,058
August 19	do	84	106	3.60	2.12	379
September 24	do	72	87	3.08	1.82	268

Mean daily gage height, in feet, of Wallowa River near Wallowa, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.70	1.70	1.95	2.20	2.70	3.80	4.20	.....	2.10	1.80	1.90	1.90
2	1.70	1.70	1.85	2.30	2.80	3.60	4.10	.....	2.10	1.80	1.90	1.90
3	1.70	1.68	1.85	2.40	2.75	3.60	4.20	.....	2.10	1.80	1.90	1.80
4	1.72	1.70	1.90	2.40	2.80	3.50	4.00	.....	2.10	1.80	1.90	1.70
5	1.75	1.70	1.95	2.50	2.80	3.70	4.00	2.30	2.10	1.80	1.90	1.70
6	1.75	1.72	2.00	2.80	2.70	4.00	4.10	2.30	2.00	2.00	1.90	1.70
7	1.74	1.68	3.02	2.50	2.70	4.00	4.00	2.00	2.00	2.00	1.90	1.70
8	1.78	1.62	3.75	2.50	2.70	3.70	3.90	2.00	2.00	1.90	1.90	1.70
9	1.72	1.56	2.90	2.55	2.75	3.70	4.00	2.20	2.00	1.90	1.90	1.80
10	1.72	1.50	2.60	2.80	2.75	3.70	4.00	2.20	2.00	1.90	1.90	1.70
11	1.74	1.70	2.70	2.80	2.80	3.50	4.00	2.30	2.00	1.90	1.90	1.80
12	1.74	1.88	2.55	2.70	2.90	3.50	3.90	2.20	2.00	2.00	1.90	1.80
13	1.80	1.68	2.45	2.80	2.90	3.50	3.70	2.20	2.00	2.00	1.90	1.80
14	1.80	1.60	2.45	3.50	3.30	3.50	3.50	2.20	1.90	2.00	1.90	1.80
15	1.75	1.68	2.50	3.70	3.00	3.30	3.40	2.20	1.90	2.10	1.90	1.80
16	1.75	2.00	2.30	3.80	3.00	3.90	3.40	2.20	1.90	2.10	1.90	1.80
17	1.80	1.85	2.30	3.50	3.10	3.70	3.20	2.20	1.90	2.10	1.90	1.80
18	1.80	1.60	2.30	3.50	3.30	4.20	3.10	2.20	1.90	2.00	1.90	1.80

Mean daily gage height, in feet, of Wallowa River near Wallowa, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
19	1.70	1.70	2.30	3.40	3.30	4.10	3.10	2.10	1.90	2.00	1.90	1.80
20	1.65	1.75	2.30	3.40	3.20	4.00	3.10	2.10	1.80	2.00	1.90	1.80
21	1.60	1.78	2.30	3.20	3.50	3.90	3.20	2.10	1.80	2.00	1.90	1.80
22	1.60	2.40	2.20	3.10	3.70	4.00	3.30	2.10	1.80	2.00	1.90	1.80
23	1.60	2.50	2.20	3.00	4.00	3.70	3.20	2.10	1.80	2.00	1.90	1.80
24	1.60	2.25	2.10	2.80	4.20	3.40	3.20	2.10	1.80	2.00	1.90	1.80
25	1.60	2.20	2.10	2.80	3.80	3.30	3.00	2.10	1.80	2.00	1.90	1.80
26	1.60	2.20	2.55	2.80	3.50	3.20	3.00	2.10	1.80	1.90	1.90	1.80
27	1.60	2.20	2.00	2.90	3.50	3.30	2.90	2.00	1.80	1.90	1.90	1.80
28	1.60	2.00	2.00	2.90	3.50	3.30	2.80	2.20	1.80	1.90	2.00	1.80
29	1.60	2.00	2.40	2.90	3.50	3.50	2.70	2.20	1.80	1.90	1.90	1.80
30	1.60	.....	2.40	2.80	3.70	3.60	2.60	2.20	1.80	1.90	1.90	2.10
31	1.65	.....	2.20	.....	3.20	.....	2.00	2.20	.....	1.90	.....	2.10

Rating table for Wallowa River near Wallowa, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.70	226	2.40	512	3.10	1,063	3.70	1,730
1.80	258	2.50	567	3.20	1,169	3.80	1,844
1.90	293	2.60	626	3.30	1,277	3.90	1,958
2.00	331	2.70	693	3.40	1.388	4.00	2,072
2.10	371	2.80	772	3.50	1,502	4.10	2,186
2.20	414	2.90	862	3.60	1,616	4.20	2,300
2.30	461	3.00	960				

The above table is applicable only for open-channel conditions. It is based upon 3 discharge measurements made during 1904. It is well defined between gage heights 1.80 feet and 3.10 feet. The table has been extended beyond these limits.

Estimated monthly discharge of Wallowa River near Wallowa, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	258	197	225	13,840
February	567	172	284	16,340
March	1,787	275	517	31,790
April	1,844	414	923	54,920
May	2,300	693	1,165	71,640
June	2,300	1,169	1,681	100,000
July	2,300	331	1,473	90,570
August [a]	461	331	397	24,410
September	371	258	303	18,030
October	371	258	311	19,120
November	331	293	294	17,490
December	371	226	261	16,050
The year	2,300	172	653	474,200

[a] Discharge interpolated August 1-4.

WALLOWA RIVER NEAR ELGIN, OREG.

This station was established November 18, 1903, by John H. Lewis. It is located at the county highway bridge just below the mouth of Minam River and 12 miles from Elgin, Oreg. The gage is in 2 sections of 2 by 6 inch timber, located under the lower side of the bridge on the left bank. Both sections are held in place by bolts, cemented into the solid rock. The lower or inclined section reads from 1.7 to 3 feet. The upper or vertical section reads from 3 to 10 feet. The gage is read once each day by John McCulloch. Discharge measurements are made from the downstream side of the single-span bridge, to which the gage is attached. On account of the velocity of the water a stay wire is used in making discharge measurements. The initial point for soundings is the end of the bridge rail on the left bank. The channel is straight for 100 feet above and for 1,000 feet below the station. Both banks are high, rocky, not liable to overflow, and without timber or brush. The current is swift. The bed of the stream is composed of gravel, free from vegetation, and not liable to shift. There is but one channel at all stages. Bench mark No. 1 is the highest point of the rock to which the vertical section of the gage is fastened. It is 6 inches from the gage rod and has an elevation of 9.60 feet above the zero of the gage. Bench mark No. 2 is the center of the hole in the rock in which the bolt supporting vertical rod is set. Its elevation is 7.07 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Wallowa River near Elgin, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
July 20	W. C. Sawyer	160	363	4.58	3.70	1,663
August 20	do	147	196	2.90	2.65	568
September 27	do	135	164	2.54	2.35	416

Mean daily gage height, in feet, of Wallowa River near Elgin, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.50	2.30	2.90	3.30	3.80	4.80	5.00	3.00	2.60	2.30	2.30	2.30
2	2.60	2.30	2.90	3.40	3.80	5.00	4.80	3.00	2.60	2.30	2.30	2.30
3	2.60	2.30	2.80	3.60	3.80	4.80	4.80	3.00	2.50	2.30	2.30	2.30
4	2.60	2.40	2.80	3.70	4.00	4.70	4.80	3.00	2.50	2.30	2.30	2.30
5	2.50	2.60	2.80	3.80	3.90	4.80	4.70	2.90	2.50	2.30	2.30	2.30
6	2.50	2.50	2.90	4.30	3.80	5.10	4.70	2.90	2.50	2.30	2.30	2.30
7	2.50	2.50	3.70	3.90	3.80	5.00	4.60	2.90	2.50	2.40	2.30	2.30
8	2.50	2.40	5.00	3.80	3.80	4.90	4.60	2.90	2.40	2.50	2.30	2.30
9	2.60	2.40	4.40	4.00	3.80	4.80	4.60	2.80	2.40	2.40	2.30	2.30
10	2.60	2.50	3.90	4.40	3.90	4.70	4.50	2.80	2.40	2.40	2.30	2.30
11	2.60	2.50	3.80	4.80	4.00	4.50	4.40	2.80	2.40	2.40	2.30	2.30
12	2.70	2.60	3.60	4.80	4.00	4.50	4.40	2.80	2.40	2.60	2.30	2.30
13	2.70	2.60	3.40	5.00	4.10	4.50	4.30	2.70	2.40	2.50	2.30	2.30
14	2.70	2.60	3.40	5.20	4.20	4.50	4.10	2.70	2.40	2.50	2.30	2.30
15	2.70	2.60	3.70	5.20	4.20	4.80	4.10	2.70	2.40	2.60	2.30	2.30
16	2.70	2.70	3.40	5.20	4.20	5.00	4.00	2.70	2.40	2.60	2.30	2.30
17	2.70	2.70	3.40	4.80	4.30	5.00	3.80	2.70	2.30	2.50	2.30	2.30
18	2.70	2.50	3.40	4.60	4.50	5.20	3.70	2.70	2.30	2.50	2.30	2.30
19	2.70	2.70	3.40	4.60	4.50	5.00	3.70	2.70	2.30	2.50	2.30	2.30
20	2.30	2.60	3.50	4.60	4.40	4.80	3.70	2.60	2.30	2.40	2.30	2.30
21	2.40	2.60	3.30	4.60	4.60	4.70	3.70	2.60	2.30	2.40	2.30	2.30
22	2.50	3.00	3.20	4.20	5.00	4.70	3.80	2.60	2.30	2.40	2.30	2.30
23	2.50	3.50	3.20	4.10	5.30	4.60	3.80	2.60	2.30	2.40	2.30	2.30
24	2.40	3.90	3.20	3.90	5.40	4.30	3.80	2.60	2.30	2.40	2.30	2.30
25	2.40	3.00	3.20	3.80	5.00	4.30	3.70	2.60	2.30	2.40	2.30	2.30
26	2.30	3.00	2.90	3.80	4.60	4.30	3.60	2.50	2.30	2.40	2.30	2.30
27	2.30	3.30	2.90	3.90	4.60	4.30	3.50	2.60	2.30	2.40	2.30	2.30
28	2.30	3.00	2.90	4.00	4.60	4.30	3.50	2.70	2.30	2.30	2.40	2.30
29	2.30	3.00	3.40	4.00	4.70	4.50	3.30	2.70	2.30	2.30	2.30	2.30
30	2.30	.....	3.60	3.90	4.80	4.60	3.20	2.60	2.30	2.30	2.30	2.30
31	2.30	.....	3.40	.....	4.80	.....	3.10	2.60	.....	2.30	.....	2.50

Rating table for Wallowa River near Elgin, Oreg., from November 21, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.30	386	3.10	926	3.90	1,946	4.70	3,082
2.40	435	3.20	1,027	4.00	2,088	4.80	3,224
2.50	488	3.30	1,137	4.10	2,230	4.90	3,366
2.60	545	3.40	1,256	4.20	2,372	5.00	3,508
2.70	606	3.50	1,384	4.30	2,514	5.10	3,650
2.80	674	3.60	1,520	4.40	2,656	5.20	3,792
2.90	750	3.70	1,662	4.50	2,798	5.30	3,934
3.00	834	3.80	1,804	4.60	2,940	5.40	4,076

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1903 and 1904. It is well defined between gage heights 2.35 feet and 3.70 feet. The table has been extended beyond these limits. Above gage height 3.70 feet the rating curve is a tangent, the difference being 142 per tenth.

Estimated monthly discharge of Wallowa River near Elgin, Oreg., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
November 17–30	1,804	545	999	27,740
December	834	488	652	40,090
1904.				
January	606	386	501	30,800
February	1,946	386	661	38,020
March	3,508	674	1,273	78,270
April	3,792	1,137	2,431	144,700
May	4,076	1,804	2,555	157,100
June	3,792	2,514	3,082	183,400
July	3,508	926	2,201	135,300
August	834	488	641	39,410
September	545	386	428	25,470
October	545	386	440	27,050
November	435	386	388	23,090
December	488	386	389	23,920
The year	4,076	386	1,250	906,400

ASOTIN CREEK 1¼ MILES ABOVE ASOTIN, WASH.

This station was established March 26, 1904, by W. W. Schlecht. It is located at the highway bridge about 1¼ miles above Asotin, Wash., at the power house of the Lewiston Water and Power Company. A plain staff gage, graduated to feet and tenths, is nailed vertically to the downstream face of the left abutment. It is read once each day by M. E. Turner. Discharge measurements are made from the side of the single-span bridge to which the gage is attached. The initial point for soundings is a 20-penny nail driven into the floor of the bridge above the mean edge of the left abutment, and marked zero. The channel is straight for about 120 feet above and 40 feet below the station, and the current is swift. Both banks are low and liable to overflow during extreme high water. They are both lined with brush, the left bank being covered with orchards and houses. The bed of the stream is composed of gravel and bowlders, free from vegetation, and fairly permanent. There is but one channel at low and two channels at high stages. At low water the current near the right bank may flow diagonally toward the center of the stream, at which times it is advisable to make the measurements from the upstream side of the bridge, while during high stages the water at the

upstream side is too swift and broken for accurate measurements. Bench mark No. 1 is a 20-penny nail driven horizontally into the guy pole for the chimney of the Lewiston Water and Power Company's power house between the power house and the bridge. It is marked "U. S. G. S. B. M." The elevation is 6.44 feet above the zero of the gage. Bench mark No. 2 is a 20-penny nail driven vertically into the stump of an old telegraph pole on the south side of the road about 100 feet from the bridge, marked "U. S. G. S. B. M." Its elevation is 7.57 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Asotin Creek 1¼ miles above Asotin, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 19	W. W. Schlecht	37	50	3.79	2.47	189
April 22	W. G. Steward	51	87	7.83	3.94	685
July 1	do	30	32	1.31	2.52	42
August 12	Hulburt and Moore	28	11	.39	2.10	5

Mean daily gage height, in feet, of Asotin Creek 1¼ miles above Asotin, Wash., for 1904.

Day.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.60	3.60	3.20	2.50	2.00	2.20	2.20	2.30	2.30
2		2.50	3.60	3.20	2.50	2.00	2.20	2.20	2.30	2.30
3		2.60	3.50	3.20	2.90	1.90	2.20	2.20	2.30	2.30
4		2.70	3.50	3.10	2.70	1.90	2.10	2.20	2.30	2.20
5		2.70	3.50	3.10	2.60	1.90	2.10	2.20	2.30	2.20
6		2.90	3.50	3.20	2.50	1.90	2.10	2.20	2.30	2.20
7		2.80	3.40	3.20	2.40	2.00	2.10	2.30	2.30	2.20
8		2.60	3.40	3.10	2.40	2.00	2.10	2.30	2.30	2.20
9		2.80	3.40	3.00	2.40	2.10	2.10	2.30	2.30	2.20
10		2.80	3.40	3.00	2.40	2.10	2.10	2.30	2.30	2.20
11		3.10	3.50	3.00	2.30	2.10	2.10	2.30	2.30	2.20
12		3.20	3.50	3.00	2.30	2.10	2.10	2.30	2.30	2.20
13		3.20	3.50	2.90	2.20	2.10	2.10	2.30	2.30	2.20
14		3.50	3.50	2.90	2.20	2.10	2.20	2.30	2.30	2.20
15		3.60	3.60	2.90	2.40	2.10	2.20	3.10	2.30	2.20
16			3.50	2.90	2.30	2.10	2.20	2.50	2.30	2.30
17		4.30	3.50	2.80	2.30	2.10	2.20	2.30	2.30	2.30
18		4.20	3.60	2.80	2.20	2.10	2.20	2.30	2.30	2.30
19		4.10	3.60	2.80	2.20	2.10	2.20	2.30	2.30	2.30
20		4.20	3.60	2.80	2.20	2.10	2.20	2.30	2.30	2.30
21		4.10	3.60	2.70	2.20	2.10	2.20	2.30	2.30	2.30
22		4.00	3.70	2.70	2.10	2.10	2.20	2.30	2.30	2.20
23		3.80	3.80	2.60	2.10	2.10	2.20	2.30	2.30	2.20
24		3.70	3.70	2.60	2.10	2.10	2.20	2.30	2.30	2.20
25		3.70	3.60	2.60	2.10	2.10	2.20	2.30	2.30	2.20
26		3.60	3.40	2.60	2.10	2.10	2.30	2.30	2.30	2.20

Mean daily gage height, in feet, of Asotin Creek 1¼ miles above Asotin, Wash., for 1904—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
27	2.10	3.80	3.30	2.50	2.00	2.10	2.30	2.30	2.30	2.20
28	2.20	3.90	3.30	2.50	2.00	2.10	2.20	2.30	2.30	2.20
29	2.70	3.80	3.20	2.50	2.00	2.30	2.20	2.30	2.30	2.30
30	2.75	3.70	3.10	2.50	2.00	2.20	2.20	2.30	2.30	2.60
31	2.50	.....	3.10	.....	2.00	2.20	.....	2.30	.....	2.40

ASOTIN CREEK AT SHELMAN'S RANCH, NEAR ASOTIN, WASH.

This station was established March 25, 1904, by W. W. Schlecht. It is located at Shelman's ranch, about 8 miles above Asotin, Wash. The station is 50 feet above the head-gate of Shelman's irrigation ditch. A plain staff gage, graduated to feet and tenths, is nailed to a tree on the left bank. It is read once each day by George Shelman. Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is a nail driven into a hub below the cable support on the left bank. The tagged wire is marked every 5 feet. The channel is straight for about 100 feet above and below the station, and the current is swift. The right bank is a flood plain about 350 feet wide which may be flooded at extreme high water. The left bank is a similar plain about 120 feet wide which overflows during high water. Both banks are lined with trees and brush. The bed of the stream is composed of gravel and bowlders, free from vegetation, and fairly permanent. There is one channel at ordinary, and two at extreme high stages. The bench mark is the top of a 40-penny nail driven horizontally into a large willow tree about 40 feet west of Shelman's house, 2 feet north of the road, marked "U. S. G. S. B. M." Its elevation is 10.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Asotin Creek at Shelman's ranch, near Asotin, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 25	W. W. Schlecht	35	31	3.61	2.03	113
April 22	W. G. Steward	40	70	6.54	3.15	458
July 1	do	30	31	3.00	1.79	92
August 12	Hulburt and Moore	26	17	2.31	1.52	40

Mean daily gage height, in feet, of Asotin Creek at Shelman's ranch, near Asotin, Wash., for 1904.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.32	2.60	2.60	1.78	1.56	1.56	1.65	1.55
2	.....	2.40	2.60	2.50	1.80	1.54	1.55	1.55	1.55
3	.....	2.50	2.50	2.55	1.92	1.54	1.65	1.55	1.55
4	.....	2.55	2.50	2.50	1.95	1.54	1.55	1.55	1.55
5	.....	2.72	2.50	2.45	1.90	1.54	1.54	1.55	1.55
6	.....	2.75	2.50	2.60	1.80	1.54	1.54	1.58	1.55
7	.....	2.65	2.40	2.50	1.79	1.54	1.53	1.58	1.55
8	.....	2.60	2.40	2.40	1.81	1.53	1.53	1.59	1.55
9	.....	2.68	2.40	2.35	1.75	1.53	1.53	1.59	1.55
10	.....	3.10	2.45	2.35	1.75	1.55	1.53	1.56	1.55
11	.....	3.45	2.50	2.20	1.70	1.55	1.53	1.56	1.55
12	.....	3.62	2.50	2.10	1.70	1.55	1.53	1.56	1.55
13	.....	3.80	2.50	2.05	1.64	1.55	1.53	1.56	1.55
14	.....	4.05	2.60	2.05	1.68	1.55	1.53	1.56	1.55
15	.....	4.30	2.60	2.05	1.72	1.55	1.53	1.79	1.55
16	.....	3.80	2.60	2.05	1.72	1.55	1.53	1.60	1.55
17	.....	3.35	2.60	2.05	1.70	1.55	1.53	1.60	1.55
18	.....	3.25	2.70	2.05	1.69	1.55	1.53	1.60	1.55
19	.....	3.25	2.70	2.05	1.66	1.55	1.53	1.60	1.55
20	.....	3.35	2.70	2.00	1.65	1.55	1.53	1.56	.....
21	2.25	3.35	2.70	1.95	1.65	1.55	1.53	1.56	.....
22	2.25	3.20	2.90	1.95	1.65	1.55	1.53	1.56	.....
23	2.20	2.95	3.00	1.90	1.61	1.55	1.66	1.56	.....
24	2.10	2.68	3.00	1.85	1.61	1.55	1.62	1.55	.....
25	2.05	2.60	2.75	1.82	1.60	1.54	1.60	1.55	.....
26	2.00	2.65	2.60	1.80	1.59	1.54	1.56	1.55	.....
27	1.95	2.90	2.50	1.80	1.59	1.55	1.58	1.55	.....
28	1.95	3.00	2.50	1.78	1.58	1.57	1.58	1.55	.....
29	2.15	2.90	2.50	1.78	1.58	1.60	1.55	1.55	.....
30	2.30	2.60	2.50	1.75	1.57	1.58	1.55	1.55	.....
31	2.30	.....	2.50	.....	1.57	1.56	.....	1.55	.....

PALOUSE RIVER AT ELBERTON, WASH.

This station was established May 6, 1904, by W. G. Steward. It is located at the highway bridge about one-half mile above the depot in the town of Elberton, Wash. A plain staff gage, graduated to feet and tenths, is nailed vertically to the south end of the face of the left abutment of the bridge. It is read once each day by W. B. Peoples. Discharge measurements are made for the west channel from the upstream side of the bridge. For the east channel, measurements are made from the downstream side of the bridge. Sounding points are painted on the guard rails. The initial point for the west channel is a point on the guard rail immediately above the face of the left abutment. The initial point for the east channel is the left end of the downstream hand rail. Both initial points are marked zero with nails and black paint. The west channel is straight for about 1,500 feet above and below the station. The current is swift. The east channel leaves the main or west channel about

150 feet above the station and makes a reverse curve striking the bridge at an angle of about 30°. The east channel is straight for 300 feet below and curved above the station. At high water the current is swift; at low water there is no flow in this channel. The right bank is high and not liable to overflow except in case of extreme high water, in which case the town would be flooded The left bank is low, and overflows during high water along the roadway to the east of the east channel. The bed of the stream is composed of rock and gravel, free from vegetation, and shifting. All the water flows in the one channel at low and two channels at high stages. Bench mark No. 1 is a 20-penny nail in a large white post on the south side of the railroad track about one-fourth mile east of the depot. Its elevation is 2,198.05 feet above sea level, and 5.80 feet above the zero of the gage. Bench mark No. 2 is a square black paint mark on the southeast window sill of the hotel. Its elevation is 2,203.91 feet above sea level, and 11.66 feet above the zero of the gage. Bench mark No. 3 is the head of a rivet in the base of the bridge truss at the southwest corner of the bridge, painted "U. S. G. S." on the plate. Its elevation is 2,206.01 feet above sea level, and 13.76 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Palouse River at Elberton, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 6	W. G. Steward	110	247	2.68	3.35	664
May 18	do	76	180	2.15	2.58	384
June 22	do	52	52	1.23	1.55	64
July 15 [a]	do	49	49	1.07	1.44	53
August 30 [a]	do	14	8	.85	.88	7

[a] Made at different sections.

Mean daily gage height, in feet, of Palouse River at Elberton, Wash., for 1904.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.00	1.60	1.10	0.90	0.90	1.20	1.40
2		2.00	1.80	1.20	.90	1.00	1.30	1.40
3		2.30	1.90	1.00	1.00	1.00	1.30	1.10
4		2.40	1.60	1.00	1.00	.90	1.10	1.10
5		2.30	1.10	1.00	.90	.90	1.10	1.10
6	3.30	2.20	1.30	0.90	.90	1.00	1.10	1.20
7	[a] 3.30	2.30	1.20	1.10	1.00	1.00	1.20	1.20
8	[a] 3.20	2.60	1.50	1.00	1.00	1.10	1.20	1.20
9	[a] 3.20	2.30	1.20	1.00	1.10	1.10	1.10	1.20

[a] Interpolated.

Mean daily gage height, in feet, of Palouse River at Elberton, Wash., for 1904—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
10	[a] 3.10	2.20	1.10	1.00	1.10	1.00	1.00	1.20
11	[a] 3.00	2.20	1.40	.90	1.00	1.00	1.00	1.10
12	[a] 3.00	2.20	1.30	.90	1.00	1.10	1.00	1.10
13	2.90	2.00	1.30	.80	1.00	1.10	1.00	1.10
14	2.80	2.00	1.30	.80	.90	1.10	1.00	1.20
15	2.70	1.90	1.40	.80	.90	1.30	1.00	1.20
16	2.70	1.90	1.40	.90	.90	1.30	1.00	1.20
17	2.70	1.80	1.40	.80	.90	1.20	1.00	1.20
18	2.60	1.70	1.30	.80	.90	1.30	1.00	1.30
19	2.60	1.70	1.50	.80	.90	1.20	0.90	1.40
20	2.60	1.80	1.50	.80	.90	1.00	1.00	1.50
21	2.50	1.60	1.60	.80	.80	1.30	1.20	1.60
22	2.50	1.60	1.40	1.00	.90	1.20	1.00	1.60
23	2.40	1.60	1.20	1.00	1.00	1.20	1.00	1.60
24	2.40	1.60	1.20	.70	.90	1.40	1.70	1.70
25	2.30	1.60	1.20	.70	.90	1.30	1.80	1.70
26	2.30	1.60	1.10	.90	.90	1.00	1.70	1.80
27	2.20	1.50	1.00	.80	.90	1.00	1.00	1.70
28	2.10	1.40	1.00	.80	.90	1.00	1.50	1.70
29	2.00	1.50	1.20	1.00	.80	1.00	1.30	1.70
30	2.00	1.50	1.20	.90	.80	1.30	1.50	1.70
31	2.00	.....	1.10	.90	.....	1.30	.....	1.70

[a] Interpolated.

Rating table for Palouse River at Elberton, Wash., from May 6 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.70	2	1.60	76	2.50	353	3.30	649
.80	5	1.70	94	2.60	390	3.40	686
.90	9	1.80	115	2.70	427	3.50	723
1.00	14	1.90	140	2.80	464	3.60	760
1.10	21	2.00	169	2.90	501	3.70	797
1.20	29	2.10	205	3.00	538	3.80	834
1.30	38	2.20	242	3.10	575	3.90	871
1.40	49	2.30	279	3.20	612	4.00	908
1.50	62	2.40	316				

The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1904. It is well defined between gage heights 0.80 foot and 3.40 feet. The table has been extended beyond these limits. Above gage height 2.10 feet the rating curve is a tangent, the difference being 37 per tenth.

Estimated monthly discharge of Palouse River at Elberton, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 6–31 [a]	330	200	402	24,720
June	316	62	162	9,640
July	140	14	45.6	2,800
August	29	5	10.1	621
September	21	5	10.7	637
October	49	9	23.1	1,420
November	115	9	31.1	1,850
December	115	21	54.4	3,340
The period				45,030

[a] Discharge May 7–12 interpolated.

PALOUSE RIVER AT HOOPER, WASH.

The headwater tributaries of this river have their sources in western Idaho. After reaching Washington they unite to form Palouse River, which has a general southwesterly direction, flowing through a rolling country. Six miles below Hooper, Wash., the river bends suddenly southward and enters its canyon, through which it continues until its junction with Snake River. For some distance above Hooper the river consists of a succession of deep pools, from 10 to 15 feet in depth, connected by short riffles. Its valley is about one-half mile in width and bordered with basaltic cliffs approximately 300 feet in height. A short distance above the mouth of the river are the Palouse Falls, which are approximately 180 feet in height.

The measurements of Palouse River are of value in showing the amount of water that could be utilized for irrigation on the lands of Washtucna Valley and in the section north of Pasco.

The gaging station is located at Hooper, Wash. Gage No. 1 was established April 1, 1897, by the land department of the Northern Pacific Railroad. On September 9, 1897, C. C. Babb took charge of the station for the United States Geological Survey, and placed gage No. 2 a mile below the former location and opposite the water tank, and stretching a cable across the river for discharge measurements. The rod was inclined, fastened to posts driven into the right bank. The bench mark was a point of rock, marked with red paint, on a ledge on the left bank of the river opposite the gage and its elevation was 7.60 feet above datum. When the new gage read 2.1 feet the height on the Northern Pacific Railroad gage was 6.1 feet.

A wire gage, No. 3, was established about 20 feet above the cable by Sydney Arnold in 1903, the datum remaining the same as for gage No. 2. The gage was repaired and checked from the original bench mark August 26, 1903. At this time it was discovered that the observer was reporting readings 0.85 too low, and the daily gage readings were adjusted back to November 9, 1900, the most probable date of error. During the high spring floods of 1904, gage No. 3 was washed away and a new gage, No. 4, was established, the same datum being used as was used for gages Nos. 2 and 3. From 1.3 to 10 feet the rod is inclined, and from 10 to 14.2 feet it is vertical. This rod is firmly fastened to the bank, graduated to feet and tenths, and painted with white paint. Gage No. 4 is the one now in use. The gage is read once each day by Frank Hill, a rancher living near the station. Discharge measurements are made by means of a cable, car, tagged wire, and stay wire. The stay wire is located about 60 feet upstream from the cable. The initial point for soundings is the cable post on the left bank. The channel is straight for 200 feet above and for one-fourth of a mile below the cable. The current is swift. The left bank is high and can not overflow. The right bank overflows during high stages of the river. Both banks are covered with brush. The bed of the stream is rocky and free from vegetation. Bowlders in the bed of the stream make it difficult to obtain accurate results at this point at low water. There is but one channel at all stages. Bench mark No. 1 is the original bench mark established by C. C. Babb. It is the highest point on a ledge of rock on the left bank 200 feet below the cable, directly opposite the point at which the inclined gage was located. It is painted black. Its elevation is 7.60 feet above gage datum. Bench mark No. 2 is the top of a large rock on the right bank 250 feet west of the cable post and 115 feet from the water's edge. Its elevation is 10.88 feet above gage datum.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Palouse River at Hooper, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
January 15	C. B. Cox	92	305	2.34	4.00	715
January 16	do	97	352	2.97	4.65	1,043
January 19	do	95	332	2.60	4.32	862
January 21	do	88	258	2.00	3.43	496
February 26	G. H. Bliss	106	515	4.00	6.15	2,050
February 27	G. F. Harley	108	554	4.37	6.57	2,420
February 29	do	106	489	4.01	6.00	1,965
March 1	do	107	473	3.78	5.74	1,790
March 4	do	101	395	3.32	5.08	1,310
March 6	do	104	427	3.44	5.32	1,470
March 8	do	213	1,068	5.52	9.85	5,900
March 8	do	216	1,071	5.99	10.40	6,410
March 10	do	253	1,939	6.75	13.50	13,080
March 10	do	237	1,647	5.87	12.35	9,670
April 1	do	110	715	5.10	7.93	3,647
April 1	do	110	715	5.24	7.92	3,750
April 2	do	110	665	4.75	7.44	3,156
April 2	do	110	654	4.91	7.38	3,210
April 13	W. G. Steward	183	939	5.35	9.06	5,020
April 13	do	183	939	5.18	9.03	4,966
June 1	do	79	165	1.50	2.50	257
July 15	do	72	99	.86	1.48	86
August 4	do	54	36	1.00	1.10	36
August 30	do	39	22	.76	.80	17

Mean daily gage height, in feet, of Palouse River at Hooper, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.10	2.70	5.90	8.20	5.70	2.50	1.60	1.10	0.80	0.85	1.00	1.30
2	2.10	2.60	5.80	7.50	5.60	2.50	1.70	1.10	.80	.85	1.00	1.30
3	2.00	2.65	5.15	7.15	5.10	2.60	1.65	1.10	.80	.85	1.00	1.35
4	2.00	2.65	5.00	7.25	4.85	2.95	1.70	1.10	.80	.85	1.10	1.25
5	2.10	2.75	5.00	7.60	4.70	3.30	1.70	1.10	.80	.85	1.10	1.25
6	2.10	3.00	5.25	7.50	4.45	3.10	2.00	1.05	.80	.85	1.05	1.25
7	2.05	3.15	6.35	7.60	4.40	2.95	1.70	1.05	.80	.85	1.05	1.20
8	2.00	3.00	9.70	7.70	4.30	3.20	1.60	1.00	.80	.85	1.05	1.15
9	2.05	2.90	14.75	7.35	4.20	3.35	1.60	1.00	.75	.90	1.10	1.10
10	2.15	2.75	13.60	6.90	4.05	3.15	1.85	1.00	.75	.90	1.10	1.20
11	2.55	2.80	12.25	7.05	3.90	2.95	1.65	.95	.75	.90	1.05	1.20
12	2.25	3.20	10.80	7.60	3.95	2.80	1.55	.95	.75	.95	1.10	1.30
13	2.70	3.10	9.20	8.90	3.95	2.70	1.45	.95	.75	.95	1.10	1.30
14	3.60	3.10	8.40	9.25	3.90	2.55	1.40	.95	.75	.95	1.10	1.30
15	3.85	3.20	8.30	9.40	3.60	2.50	1.40	.95	.80	1.00	1.10	1.35

Mean daily gage height, in feet, of Palouse River at Hooper, Wash., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	4.70	3.85	8.45	9.60	3.55	2.40	1.50	.95	.80	1.00	1.10	1.4
17	4.40	4.10	8.25	9.90	3.50	2.30	1.45	.90	.80	1.00	1.10	1.4
18	4.60	4.70	7.95	10.30	3.45	2.20	1.45	.90	.80	1.00	1.05	1.4
19	4.35	4.55	8.30	8.30	3.40	2.15	1.45	.90	.80	1.10	1.05	1.4
20	3.85	4.55	8.40	7.25	3.35	2.10	1.35	.85	.80	1.05	1.10	1.4
21	3.50	4.30	8.30	7.15	3.35	2.05	1.35	.85	.85	1.10	1.15	1.4
22	3.30	4.25	8.85	7.10	3.30	2.00	1.35	.85	.85	1.10	1.15	1.7
23	3.30	4.50	7.90	7.00	3.20	2.00	1.35	.85	.85	1.10	1.20	1.5
24	3.40	6.00	7.55	6.70	3.10	1.90	1.25	.85	.85	1.10	1.20	1.5
25	3.25	5.95	6.90	6.30	3.00	1.90	1.25	.85	.85	1.05	1.30	1.4
26	3.05	6.20	6.85	5.70	2.90	1.85	1.20	.80	.85	1.10	1.20	1.3
27	2.90	6.35	6.35	5.35	2.90	1.80	1.20	.80	.85	1.10	1.25	1.3
28	2.85	6.60	6.25	5.20	2.80	1.80	1.15	.80	.85	1.10	1.35	1.4
29	2.90	6.30	6.65	5.45	2.70	1.90	1.15	.80	.85	1.10	1.40	1.2
30	2.85	.....	6.95	5.70	2.55	1.75	1.15	.80	.85	1.10	1.30	1.3
31	2.80	.....	8.80	.....	2.50	.....	1.15	.80	.....	1.05	.....	1.3

Rating table for Palouse River at Hooper, Wash., from January 1, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.60	10	2.30	215	4.00	715	7.50	3,270
.70	13	2.40	236	4.20	805	8.00	3,780
.80	17	2.50	259	4.40	900	8.50	4,330
.90	22	2.60	283	4.60	1,015	9.00	4,880
1.00	28	2.70	307	4.80	1,135	9.50	5,470
1.10	36	2.80	331	5.00	1,265	10.00	6,080
1.20	46	2.90	355	5.20	1,400	10.50	6,750
1.30	57	3.00	380	5.40	1,540	11.00	7,550
1.40	69	3.10	405	5.60	1,680	11.50	8,500
1.50	82	3.20	430	5.80	1,820	12.00	9,530
1.60	96	3.30	457	6.00	1,965	12.50	10,650
1.70	110	3.40	486	6.20	2,120	13.00	11,880
1.80	125	3.50	517	6.40	2,280	13.50	13,180
1.90	141	3.60	551	6.60	2,440	14.00	14,480
2.00	158	3.70	588	6.80	2,620	15.00	17,080
2.10	176	3.80	628	7.00	2,800	16.00	19,680
2.20	195	3.90	670				

The above table is applicable only for open-channel conditions. It is based upon 34 discharge measurements made during 1903 and 1904. It is well defined between gage heights 0.80 foot and 13.50 feet. The table has been extended beyond these limits. Above gage height 12.90 feet the rating curve is a tangent, the difference being 260 per tenth.

Estimated monthly discharge of Palouse River at Hooper, Wash., for 1904.

[Drainage area, 2,210 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	1,075	158	409	25,150	0.185	0.213
February	2,440	283	873	50,220	.395	.426
March	16,430	1,265	4,305	264,700	1.95	2.25
April	6,470	1,400	3,351	199,400	1.52	1.70
May	1,750	259	678	41,690	.307	.354
June	471	117	258	15,350	.117	.130
July	158	41	78.8	4,845	.036	.042
August	36	17	24.5	1,506	.011	.013
September	19	15	17.3	1,029	.0078	.0087
October	36	19	27.8	1,709	.013	.015
November	69	28	39.6	2,356	.018	.020
December	117	36	63.0	3,874	.029	.033
The year	16,430	15	844	611,800	.382	5.20

ROCK CREEK NEAR ST. JOHN, WASH.

This station was established October 15, 1903, by G. H. Bliss. It is located at the highway bridge which crosses Rock Creek at the outlet of Rock Lake, three-fourths of a mile from the ranch of the observer, C. K. Reimer. It is 9 miles northeast of St. John, Whitman County, Wash. The gage is a vertical rod fastened to the fifth pile bent of the southeast or left-bank approach. At high stages discharge measurements are made from the downstream side of the highway bridge, to which the gage is attached. At low stages they are made by wading below the bridge. The bridge is supported by pile bents and has a total span of 210 feet. The initial point for soundings is the end post of the downstream hand rail. The channel is straight for 200 feet above and for 75 feet below the station. The current is sluggish at the bridge at low stages. Both banks are low and rocky and liable to overflow at flood stages. The bed of the stream is covered with rocks and gravel and is liable to shift at flood stages. Bench mark No. 1 is a spike driven into the downstream side of the top of the sill of the third pile bent from the southeast or left-bank approach. Its elevation is 12.52 feet above the zero of the gage. Bench mark No. 2 is the top of a large rock on a point of rocks on the southeast side of the lake about 3,000 feet above the outlet. Its elevation is 16.70 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Rock Creek near St. John, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
y 29	G. H. Bliss	70	38	2.98	11.99	112
ary 29 [a]	do	102	159	3.16	13.84	502
March 11	do	181	833	1.86	14.95	1,549
March 13	do	179	784	1.52	14.40	1,190
April 5	W. G. Steward	177	478	1.04	13.20	502
May 17	do	64	39	2.59	11.55	100
June 24	do	46	30	1.24	10.96	37
August 29	T. A. Noble	3	0.9	0.57	10.20	0.5

[a] From boat 2 miles below station.

Mean daily gage height, in feet, of Rock Creek near St. John, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.00	11.90	13.80	13.60	12.10	11.20	10.80	10.50	10.15	10.00	10.05	10.10
2	11.00	11.90	13.75	13.50	12.05	11.20	10.80	10.50	10.15	10.00	10.05	10.10
3	11.00	11.90	13.60	13.40	12.00	11.25	10.80	10.50	10.15	10.00	10.05	10.10
4	11.00	11.90	13.60	13.30	12.00	11.25	10.80	10.45	10.15	10.00	10.05	10.10
5	11.00	11.90	13.50	13.20	11.95	11.25	10.80	10.45	10.15	10.00	10.05	10.10
6	11.00	11.90	13.55	13.10	11.95	11.25	10.80	10.40	10.15	10.00	10.05	10.10
7	11.00	11.90	14.00	13.10	11.90	11.25	10.80	10.40	10.15	10.00	10.05	10.15
8	11.00	11.90	15.20	13.05	11.90	11.25	10.80	10.40	10.10	10.00	10.05	10.15
9	11.00	11.90	15.60	12.95	11.85	11.25	10.80	10.40	10.10	10.00	10.05	10.15
10	11.05	11.90	15.40	12.85	11.85	11.20	10.80	10.40	10.10	10.05	10.05	10.20
11	11.05	11.90	15.00	12.80	11.80	11.20	10.80	10.40	10.10	10.05	10.05	10.20
12	11.10	11.90	14.70	12.75	11.75	11.20	10.80	10.40	10.10	10.00	10.05	10.20
13	11.15	11.90	14.60	12.70	11.70	11.15	10.80	10.40	10.10	10.00	10.05	10.20
14	11.25	11.90	14.45	12.65	11.65	11.10	10.75	10.40	10.10	10.00	10.05	10.20
15	11.40	11.95	14.25	12.60	11.60	11.10	10.75	10.40	10.10	10.00	10.05	10.20
16	11.60	12.00	14.10	12.50	11.60	11.10	10.70	10.40	10.10	10.00	10.05	10.25
17	11.80	12.10	14.00	12.55	11.55	11.10	10.70	10.35	10.05	10.00	10.05	10.30
18	11.95	12.20	13.85	12.60	11.50	11.10	10.65	10.35	10.05	10.00	10.05	10.30
19	12.10	12.30	13.85	12.55	11.50	11.10	10.65	10.35	10.05	10.00	10.05	10.30
20	12.15	12.45	13.90	12.50	11.50	11.10	10.60	10.30	10.05	10.00	10.05	10.30
21	12.15	12.50	13.90	12.50	11.45	11.05	10.60	10.30	10.05	10.00	10.05	10.35
22	12.10	12.55	13.90	12.45	11.40	11.00	10.60	10.30	10.05	10.00	10.05	10.35
23	12.10	12.60	13.80	12.40	11.40	11.00	10.60	10.30	10.00	10.00	10.05	10.40
24	12.10	12.85	13.75	12.35	11.40	11.00	10.60	10.30	10.00	10.00	10.05	10.40
25	12.10	13.10	13.70	12.30	11.35	10.95	10.60	10.25	10.00	10.05	10.05	10.40
26	12.05	13.30	13.60	12.30	11.35	10.95	10.55	10.25	10.00	10.05	10.05	10.40
27	12.00	13.50	13.50	12.25	11.30	10.90	10.55	10.20	10.00	10.05	10.05	10.40
28	12.00	13.80	13.40	12.20	11.30	10.85	10.55	10.20	10.00	10.05	10.05	10.40
29	12.00	13.80	13.35	12.10	11.30	10.85	10.55	10.20	10.00	10.05	10.10	10.45
30	11.95	.....	13.50	12.10	11.30	10.85	10.50	10.20	10.00	10.05	10.10	10.50
31	11.90	.....	13.60	.....	11.25	.....	10.50	10.20	.....	10.05	.....	10.50

Rating table for Rock Creek near St. John, Wash., from October 15, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
10.00	0	11.20	59	12.40	245	13.50	650
10.10	.5	11.30	70	12.50	267	13.60	705
10.20	1.5	11.40	82	12.60	292	13.70	760
10.30	3	11.50	94	12.70	320	13.80	820
10.40	6	11.60	107	12.80	350	13.90	880
10.50	10	11.70	120	12.90	383	14.00	940
10.60	14	11.80	134	13.00	420	14.20	1,070
10.70	19	11.90	149	13.10	460	14.40	1,200
10.80	25	12.00	165	13.20	505	14.60	1,330
10.90	32	12.10	183	13.30	550	14.80	1,460
11.00	40	12.20	203	13.40	600	15.00	1,590
11.10	49	12.30	223				

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1903 and 1904. It is well defined between gage heights 10.20 feet and 15.00 feet. The table has been extended beyond these limits. Above gage height 14.00 feet the rating curve is a tangent, the difference being 65 per tenth.

Estimated monthly discharge of Rock Creek, near St. John, Wash., for 1903 and 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
October 15–31	1.5	0.3	0.48	16
November	8	.4	3.66	218
December	38.0	8	20.0	1,230
1904.				
January	193	40	109	6,702
February	820	149	268	15,420
March	1,980	575	969	59,580
April	705	183	345	20,530
May	183	64	113	6,948
June	64	28	49.7	2,957
July	25	10	19.1	1,174
August	10	1.5	4.9	301
September	1	0	.42	25
October	.2	0	.06	3.7
November	.5	.2	.22	13
December	10	.5	3.3	203
The year	1,980	0	157	113,900

COW CREEK NEAR KEYSTONE, WASH.

This station was established November 10, 1904, by Calvin Casteel. It is located at the highway bridge on the Sprague-Ritzville road crossing of Cow Creek, 2¼ miles east of Keystone, Wash., and one-fourth mile southeast of Lakeview schoolhouse. The station is a short distance below the foot of Colville Lake. A plain staff gage is nailed vertically to a post of the bridge at the upper left end. It is read once each day by S. A. Fulquartz. Discharge measurements are made from the upstream side of the single-span bridge, to which the gage is attached. The bridge is 18.6 feet long between abutments. The initial point for soundings is a nail driven into the end of a plank on the deck of the bridge above the edge of the abutment. The channel is straight for about 200 feet above and 100 feet below the station. The current above the station is moderate at ordinary and sluggish at low stages; below the station it is swift at all stages. Both banks are high, clean, and not liable to overflow. The bed of the stream is composed of rock and gravel, and is permanent. There is but one channel at all stages. The bench mark is a United States Geological Survey standard aluminum tablet set in a large bowlder, 125 feet up Cow Creek from Sprague-Ritzville road crossing, on the right bank. The bench mark is marked 1883. Its elevation is 1,883.150 feet above sea level and 4.19 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Cow Creek near Keystone, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
November 8	C. Casteel	7	4	0.58	0.61	3
November 8	do	7	4.5	.58	.61	2.6

Mean daily gage height, in feet, of Cow Creek near Keystone, Wash., for 1904.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.72	12		0.77	22	0.68	0.8
2		.72	13	0.62	.78	23	.70	.8
3		.71	14	.48	.80	24	.71	.8
4		.70	15	.65	.77	25	.72	.8
5		.71	16	.63	.78	26	.73	.8
6		.71	17	.63	.78	27	.73	.8
7		.72	18	.61	.82	28	.74	.8
8		.73	19	.65	.82	29	.75	.8
9		.74	20	.65	.83	30	.74	.8
10	0.61	.75	21	.67	.82	31		.8
11	.62	.76						

COW CREEK AT HOOPER, WASH.

This station was established February 26, 1904, by G. H. Bliss. It is located one-half mile east of Hooper, Wash., about a half mile above the point where the creek empties into Palouse River. A plain vertical staff gage graduated to feet and tenths is driven into the bed of the stream and braced to a stake on the left bank. The gage is read only at the time of making meter measurements. Discharge measurements are made by wading at the gage. The initial point for soundings is a nail driven into the top of the stake, to which the gage is braced. The channel is straight for about 50 feet above and 25 feet below the station. The current is fairly swift at flood stages. Both banks are high and clean. The right bank may overflow during flood stages. The bed of the stream is composed of clean sand, and is permanent. There is but one channel at all stages. Bench mark No. 1 is the top of the nail, which serves as the initial point for soundings. Its elevation is 7.68 feet above the zero of the gage. Bench mark No. 2 is a mark on a large rock 100 feet south and a little to the west of the gage. A piece has been broken from the east face of the rock, and it is marked "B. M." The elevation of this bench mark is 8.56 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurements of Cow Creek at Hooper, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 26	G. H. Bliss	25	22	1.41	4.80	32
March 7	Geo. F. Harley	25	22	1.78	4.82	46
August 5	W. G. Steward	3	1	.85	4.32	1
August 31 [a]	do	12	10	.44	4.46	4

[a] 75 feet above gage.

WALLA WALLA RIVER (SOUTH FORK) NEAR MILTON, OREG.

This station was originally established February 15, 1903, 6 miles above the mouth of the river and 12 miles from Milton, Oreg. The gage was read once each day from the date of establishment to October 31, 1903, by N. Redden. As there were no means for making flood measurements at this point, the station was moved to the highway bridge one-fourth mile above the junction of the North and South forks, 6 miles from Milton. The gage is a vertical 1¼ by 9 inch timber, secured to a stump on the right bank three-fourths mile above the highway bridge and directly back of the house of the observer,

Harry Huber, who reads the gage once each day. Discharge measurements are made from the upstream side of the single-span highway bridge one-fourth mile above the mouth of the South Fork. The initial point for soundings is the south side of a projecting beam which supports the north end of the lower chord of the bridge. The bridge has a span of 65 feet between abutments. The channel is straight for 100 feet above, and for 150 feet below the bridge. The current is swift. The right bank is low, wooded, and liable to overflow. The left bank is low, but is not liable to overflow, and is without trees. The bed of the stream is composed of gravel, free from vegetation, and not liable to shift to any considerable extent. Bench mark No. 1 is a 20-penny nail driven into a cottonwood tree 1 foot in diameter 15 feet above the gage rod. Its elevation is 7.00 feet above the zero of the gage. Bench mark No. 2 is a 20-penny nail driven into the tree to which the gage is attached. Its elevation is 7.00 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Walla Walla River (South Fork) near Milton, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 15	Yates and Saxton	60	136	5.70	2.70	955
May 14	Murphy and Sawyer	49	74	6.80	2.18	505
August 12	W. C. Sawyer	32	33	3.50	1.51	118
October 20	do	35	32	3.59	1.52	113

[a] 6 miles above railroad station.

Mean daily gage height, in feet, of Walla Walla River (South Fork) near Milton, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.75	1.70	1.90	1.85	.....	2.00	1.60	1.55	.....	.....	1.50	1.50
2	1.75	1.70	1.95	1.75	2.10	1.90	1.60	.....	.....	.....	1.50	1.50
3	1.75	1.70	1.90	1.85	2.20	1.90	1.60	.....	.....	1.50	1.50	1.50
4	1.75	1.70	1.90	.....	2.10	1.90	.....	1.55	.....	1.50	1.50	1.50
5	1.70	1.70	1.90	1.75	2.00	.....	1.65	.....	.....	1.50	1.50	1.50
6	1.70	1.70	2.00	1.95	2.05	1.95	1.60	.....	1.50	1.50	1.50	1.50
7	1.70	.....	2.40	1.85	2.10	1.85	1.60	.....	.....	1.55	1.50	1.50
8	1.70	1.70	2.70	1.80	2.00	1.80	1.65	.....	1.50	.....	1.50	1.55
9	1.75	1.70	2.45	1.85	2.00	1.75	1.60	1.55	.....	1.55	1.50	1.55
10	1.80	1.70	2.10	.....	2.20	1.75	.....	.....	.....	1.50	1.50	1.55
11	1.80	.....	1.90	2.40	2.15	1.70	1.60	.....	.....	1.50	1.50	1.55
12	1.80	1.70	1.80	2.65	2.20	1.70	1.60	1.51	.....	1.60	1.50	1.55
13	1.90	1.75	1.80	2.90	2.20	1.65	1.55	.....	.....	1.55	1.50	1.55
14	2.00	1.70	1.70	3.40	2.15	1.65	1.55	1.50	.....	1.55	1.55	1.60
15	2.10	1.85	1.80	3.20	.....	1.65	1.60	.....	.....	1.60	1.55	1.60
16	2.00	2.10	1.75	2.50	2.10	1.65	1.60	.....	1.50	1.55	1.55	1.60
17	2.00	2.00	1.70	.....	2.10	1.65	1.65	.....	1.50	1.55	1.55	1.60
18	1.95	1.95	1.75	2.30	.....	1.65	1.65	.....	1.50	1.55	1.55	1.60
19	1.80	1.90	1.70	2.50	.....	1.60	1.65	.....	.....	1.60	.....	1.60
20	1.85	1.85	1.80	2.50	2.15	1.60	1.60	.....	.....	1.55	1.55	1.60
21	1.85	1.80	1.75	2.35	2.20	1.60	1.60	1.50	1.50	1.55	1.55	1.60

Mean daily gage height, in feet, of Walla Walla River (South Fork) near Milton, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
22	1.80	2.00	1.70	2.20	2.20	.....	1.60	.....	.....	1.55	1.55	1.60
23	1.85	2.05	1.60	2.10	2.25	1.55	1.60	.....	1.50	1.50	1.60	1.55
24	.....	2.00	1.50	2.00	2.10	1.50	1.60	.....	.....	1.50	.....	1.60
25	1.85	2.00	1.50	2.00	2.00	.....	.....	.....	1.50	1.50	1.60	1.60
26	1.80	2.00	1.45	2.05	1.95	1.55	1.55	.....	.....	1.50	1.60	1.60
27	1.75	2.05	1.45	2.20	1.90	1.60	1.55	.....	.....	1.50	1.60	1.60
28	.....	2.00	1.50	2.25	1.90	1.60	1.55	1.50	1.50	1.50	1.60	1.60
29	1.75	2.00	1.85	2.20	.....	1.60	1.55	.....	1.50	.....	1.50	1.60
30	.....	.....	2.00	2.10	1.90	1.60	1.55	.....	1.50	1.50	1.50	1.78
31	1.70	.....	1.80	.....	.....	.....	1.55	.....	.....	1.50	.....	1.75

Rating table for Walla Walla River (South Fork) near Milton, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.40	71	2.00	374	2.50	765	3.00	1,255
1.50	109	2.10	443	2.60	858	3.10	1,355
1.60	152	2.20	516	2.70	955	3.20	1,455
1.70	200	2.30	595	2.80	1,055	3.30	1,555
1.80	253	2.40	678	2.90	1,155	3.40	1,655
1.90	310						

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904. It is well defined between gage heights 1.50 feet and 2.70 feet. The table has been extended beyond these limits. Above gage height 2.70 feet the rating curve is a tangent, the difference being 100 per tenth.

Estimated monthly discharge of Walla Walla River (South Fork) near Milton, Oreg., for 1904.

Month.	Discharge in second-feet.[a]			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	443	200	264	16,230
February	443	200	282	16,220
March	955	90	294	18,080
April	1,655	226	569	33,860
May	555	310	433	26,620
June	374	109	203	12,080
July	175	130	149	9,162
August	130	109	117	7,194
September	109	109	109	6,486
October	152	109	121	7,440
November	152	109	124	7,379
December	242	109	143	8,793
The year	1,655	90	234	169,500

[a] Discharge interpolated for missing gage heights.

WALLA WALLA RIVER AT MILTON, OREG.

This station was established February 14, 1903, by T. A. Noble. The gage is a vertical rod on the left bank one-half mile above the county bridge and just above the head-gate of an irrigation ditch. The gage is read once each day by S. L. Smith. During 1903 discharge measurements were made from a cable just above the gage. Measurements made at this point include the discharge of the irrigation ditch just below the gage. On October 29, 1903, a stay wire was installed about 35 feet above the county bridge, to be used in making flood measurements. At the close of the season of 1903 the cable was abandoned, and discharge measurements have since been made from the highway bridge. Measurements made at this point do not include the discharge of the irrigation ditch just below the gage. This ditch has to be measured separately, but is included in the estimate given below. There is another irrigation ditch taken out on the left bank just below the bridge, which is included in the measurements made at the bridge. The gage heights have been adjusted to obviate the effect of changes in a diversion dam below the gage. The initial point for soundings is the end of the lower chord on the upstream side of the bridge at the right bank. The bridge has a single span of 75 feet between abutments. The channel is straight for 80 feet above and for 150 feet below the station. The current is swift. Both banks are low, wooded, but not liable to overflow. There is but one channel at all stages. The bed of the stream is composed of gravel, free from vegetation, and liable to shift. The bench mark is the top of a sharp projecting rock 4 feet from the gage and 3 feet from the tree to which the gage is attached. Its elevation is 4.37 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Walla Walla River at Milton, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
April 16	H. A. Yates	66	186	7.46	2.5	1,387
May 14	Murphy and Sawyer	64	107	6.70	1.93	715
June 13	W. C. Sawyer	46	64	3.55	1.37	267
August 12	do	44	40	2.42	1.01	139
October 20	do		43	3.37	1.05	145

Mean daily gage height, in feet, of Walla Walla River at Milton, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.04	0.96	1.33	1.91	1.80	1.58	1.13	1.01	1.03	1.01	1.08	1.17
2	1.04	.96	1.36	1.90	1.72	1.68	1.12	1.01	1.03	1.00	1.09	1.17
3	1.04	.96	1.28	1.93	1.81	1.68	1.11	1.01	1.02	.98	1.09	1.17
4	1.03	.95	1.33	1.95	1.92	1.67	1.20	1.00	1.02	.99	1.10	1.19
5	1.02	.95	1.30	1.88	1.88	1.65	1.20	1.00	1.01	1.00	1.10	1.18
6	1.00	.96	1.47	2.10	1.86	1.63	1.18	1.00	1.00	1.00	1.10	1.16
7	1.02	.95	1.85	1.95	1.81	1.65	1.22	1.01	1.00	1.02	1.10	1.18
8	1.03	.95	3.20	1.90	1.78	1.58	1.20	1.01	1.00	1.02	1.10	1.19
9	1.02	.95	2.66	1.95	[illegible]	1.53	1.17	1.01	1.00	1.01	1.11	1.16
10	1.10	.92	2.20	2.31	1.98	1.50	1.16	1.00	1.00	1.01	1.13	1.14
11	1.07	.92	2.02	2.60	2.00	1.47	1.14	1.01	.99	1.06	1.12	1.16
12	1.22	1.01	1.90	2.92	1.96	1.43	1.13	1.01	.99	1.11	1.14	1.17
13	1.50	.99	1.75	2.93	1.97	1.38	1.12	1.00	.98	1.06	1.14	1.16
14	1.45	.97	1.73	3.20	1.98	1.37	1.11	1.00	.97	1.04	1.15	1.20
15	1.43	1.03	1.85	3.00	1.95	1.35	1.15	1.00	.94	1.10	1.16	1.19
16	1.38	1.45	1.80	2.51	1.90	1.34	1.20	1.01	.94	1.09	1.17	1.18
17	1.36	1.43	1.74	2.43	1.90	1.36	1.14	1.01	.94	1.07	1.18	1.17
18	1.33	1.30	1.70	2.31	1.92	1.36	1.12	1.00	.94	1.06	1.19	1.19
19	1.30	1.20	1.74	2.45	2.01	1.35	1.11	1.01	.94	1.05	1.19	1.20
20	1.16	1.22	1.84	2.55	2.02	1.35	1.10	1.02	.93	1.05	1.22	1.20
21	1.15	1.15	1.76	2.33	2.03	1.34	1.09	1.00	.93	1.06	1.22	1.21
22	1.21	1.45	1.72	2.21	2.02	1.32	1.08	1.00	.93	1.06	1.21	1.20
23	1.19	1.47	1.69	2.08	2.02	1.25	1.07	1.01	1.04	1.06	1.19	1.19
24	1.15	1.44	1.65	2.01	2.01	1.22	1.07	1.00	1.04	1.07	1.18	1.19
25	1.13	1.37	1.54	1.92	1.84	1.20	1.05	1.00	1.00	1.06	1.18	1.18
26	1.10	[illegible]	1.50	2.05	1.78	1.18	1.04	1.01	1.05	1.05	1.17	1.18
27	1.07	1.45	1.47	2.11	1.72	1.16	1.03	1.00	1.01	1.05	1.16	1.17
28	1.04	1.40	1.54	2.18	1.67	1.17	1.03	1.01	1.00	1.04	1.15	1.17
29	1.02	1.36	1.95	2.08	1.62	1.16	1.02	1.01	1.00	1.04	1.16	1.22
30	1.00	.....	2.21	2.18	1.61	1.14	1.02	1.02	1.00	1.07	1.17	1.40
31	.98	.....	1.98	.....	1.60	.....	1.01	1.02	.....	1.07	.....	1.42

Rating table for Walla Walla River at Milton, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.90	120	1.50	339	2.10	913	2.70	1,625
1.00	135	1.60	408	2.20	1,031	2.80	1,744
1.10	159	1.70	488	2.30	1,149	2.90	1,863
1.20	192	1.80	577	2.40	1,268	3.00	1,982
1.30	233	1.90	679	2.50	1,387	3.10	2,101
1.40	281	2.00	795	2.60	1,506	3.20	2,220

The above table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1904, and is fairly well defined.

Estimated monthly discharge of Walla Walla River at Milton, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	339	131	183	11,250
February	321	122	195	11,220
March	2,220	225	606	37,260
April	2,220	658	1,105	65,750
May	830	408	654	40,210
June	472	171	297	17,670
July	200	137	165	10,140
August	139	135	136	8,362
September	146	124	134	7,974
October	162	131	145	8,916
November	200	154	175	10,410
December	292	171	192	11,810
The year	2,220	122	332	241,000

UMATILLA RIVER AT GIBBON, OREG.

This station was established by C. C. Babb July 22, 1896. The original gage rod was located one-fourth mile below the railroad station. The gage, together with the cable from which discharge measurements were made, was carried away by a flood in May, 1902. The bench mark, consisting of a cross on the highest point of the rock to which the original gage was fastened, has also been destroyed. On September 10, 1902, the station was reequipped with a wire gage, cable, and car. The cable is located in its original position. To secure a better location for the gage the new wire gage was established a few hundred feet nearer the cable. It was located on a beam projecting over the water and spiked to the top of the cribwork on the left bank about 10 feet north of the railroad track. The wire gage was repaired July 29, 1903, but no change was made in the datum. The length of the wire from the marker to the bottom of the eye in the center of the web of the section of the rail, used as a weight, was 16.30 feet. Bench mark No. 1 is the head of a 40-penny spike driven flush with the surface of the crib timber opposite the 1-foot mark of the gage scale. Its elevation is 8.66 feet above gage datum. Bench mark No. 2 is a 40-penny spike in a telegraph pole directly across the railroad track from the gage and 30 feet distant. Its elevation is 10.35 feet above gage datum.

The flood in March and April, 1904, changed the channel at the gage to such an extent that the gage was rendered useless. A vertical staff gage, graduated to feet and tenths, was bolted and braced,

on October 15, 1904, to a point of rocks in a pool where the bed is least liable to shift, on the north side of the river, about one-half mile below the railroad station at Bingham Springs and one-half mile above the cable from which discharge measurements are made. The bench mark for this gage is a square chisel draft, and the letters "B. M." cut in the rock about 15 feet from the gage, 10 feet downstream. Its elevation is 5.17 feet above the zero of the gage. No relation has been established between this and previous gages. During 1904 the gage was read once each day by Walter Swart. The initial point for soundings is the face of the tree to which the cable is attached, on the right bank. The channel is straight for 100 feet above and below the cable. The right bank is high. The left bank is rather low, and has a slough during high water. The bed of the stream is composed of gravel and is somewhat shifting.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Umatilla River at Gibbon, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 19	J. H. Lewis	120	188	6.3	1.85	1,180
April 14	Brainard and Saxton	144	683	8.34	5.63	5,715
April 25	W. C. Sawyer	111	234	6.79	1.00	1,591
October 14	do	.....	35	2.80	[a] 1.17	98

[a] New gage.

Mean daily gage height, in feet, of Umatilla River at Gibbon, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.00	1.30	1.70	2.00	0.80	.....	.....	.....	.....	.....	1.20	1.30
2	1.00	1.30	1.60	2.25	.70	.....	.....	.....	.....	.....	1.20	1.20
3	1.00	1.30	1.60	2.70	.90	.....	.....	.....	.....	.....	1.20	1.20
4	1.00	1.25	1.50	2.50	.90	.....	.....	.....	.....	.....	1.20	1.20
5	1.00	1.25	.....	2.30	.80	.....	.....	.....	.....	.....	1.20	1.20
6	1.00	1.25	2.20	3.20	.70	.....	.....	.....	.....	.....	1.20	1.20
7	1.00	1.20	3.35	2.60	.70	.....	.....	.....	.....	.....	1.10	1.20
8	1.00	1.20	4.75	2.60	.70	.....	.....	.....	.....	.....	1.10	1.20
9	1.10	1.20	3.60	3.00	.70	.....	.....	.....	.....	.....	1.10	1.20
10	1.20	1.20	2.85	4.00	.70	.....	.....	.....	.....	.....	1.10	1.20
11	1.20	1.20	2.40	4.40	.70	.....	.....	.....	.....	.....	1.10	1.20
12	1.40	1.20	2.00	4.60	.70	.....	.....	.....	.....	.....	1.10	1.20
13	1.80	1.20	1.70	5.20	.70	.....	.....	.....	.....	.....	1.10	1.20
14	1.90	1.20	1.80	5.35	.60	.....	.....	.....	.....	.....	1.10	1.30
15	2.10	1.30	1.80	4.80	.60	.....	.....	.....	.....	1.17	1.20	1.30
16	2.00	1.90	1.70	4.00	.60	.....	.....	.....	.....	.....	1.20	1.30
17	1.90	1.80	1.60	3.50	.50	.....	.....	.....	.....	1.22	1.20	1.30
18	1.80	1.70	1.80	3.20	.50	.....	.....	.....	.....	.....	1.20	1.30
19	1.50	1.60	1.80	3.50	.60	.....	.....	.....	.....	1.20	1.20	.....
20	1.40	1.90	1.90	2.70	.70	.....	.....	.....	.....	1.20	1.20	1.30

Mean daily gage height, in feet of Umatilla River at Gibbon, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	1.40	1.70	1.75	.....	.60	.....	.....	.....	.....	1.15	1.20	1.30
22	1.90	1.60	1.50	1.70	.50	.....	.....	.....	.....	1.10	1.20	1.30
23	2.00	2.10	1.40	1.10	.40	.....	.....	.....	.....	1.10	1.20	1.30
24	1.90	2.10	1.10	.90	.30	.....	.....	.....	.....	1.20	1.20	1.30
25	1.80	2.00	1.00	1.00	.10	.....	.....	.....	.....	1.20	1.20	.....
26	1.60	2.00	1.00	.....	.00	.....	.....	.....	.....	1.20	1.20	1.30
27	1.50	1.90	1.00	1.50	.....	.....	.....	.....	.....	1.20	1.20	1.30
28	1.40	1.80	1.10	1.50	.....	.....	.....	.....	.....	1.20	1.30	1.30
29	1.50	1.80	2.10	1.20	.....	.....	.....	.....	.....	1.20	1.30	1.40
30	1.30	.....	2.60	1.00	.....	.....	.....	.....	.....	1.20	1.30	1.50
31	1.30	.....	2.20	.....	.....	.....	.....	.....	.....	1.20	.....	1.70

NOTE.—Gage heights October 15 to December 31 referred to new gage.

UMATILLA RIVER AT PENDLETON, OREG.

This station was established May 22, 1903, by F. W. Huber. It is located at the Main Street Bridge at Pendleton, Oreg. A short distance above the bridge at which the gage is located water is taken out of the river by the Farmers Mill ditch. This ditch carries from 30 to 50 second-feet, and at low stages the entire river is diverted into this ditch. The water is returned to the river at a point about 4,000 feet below the Main Street Bridge and about 1,500 feet above the railroad bridge, at which discharge measurements are made. The original river gage was a vertical 1 by 5 inch board, 10 feet long, spiked to the middle of the left or south side of the center pier of the Main Street Bridge. On July 18, 1903, this gage was replaced by a 2 by 6 inch board, 10 feet long, fastened in the same position as the original gage and on the same datum. During 1904 the gage has been read by the Geological Survey office at Pendleton. Discharge measurements are made from the Oregon Railroad and Navigation Company's bridge, about 1 mile downstream from the gage. The initial point for soundings is the face of the crib abutment on the left bank. The railroad bridge consists of a single span of 145 feet, there being 116 feet of trestle approach on the right bank and an approach of 34 feet on the left bank. The channel is straight for 250 feet above and 200 feet below the railroad bridge. The current is swift at this point, but has a lower velocity than at the bridge at which the gage is located. The right bank is low and will overflow under the trestle on this bank. The left bank is high and is partly riprap. At low stages there will be some backwater at the south bank. There is but one channel at all stages. The bed of the stream is composed of gravel and is shifting. The bench mark is the top of the south side of the steel caisson at the east end of the middle pier of the Main Street Bridge. Its elevation is 16.50 feet above the zero of the gage.

The flour mill ditch (Byer's) takes 100 second-feet or more of water

about a mile and a half above the gage and returns it to the river about 200 feet above the gage, so that it interferes with the measurements in no way except for a time during very low water, when the water is drawn down and then stored again. The gage was read only when the flow was normal. This accounts for the few gage heights during the summer.

The Farmers Mill ditch does not affect the reading of the gage when above 4 feet. When the water is below that height it takes about 40 second-feet of water from the river above the gage and returns it above the bridge, where measurements are made; so for low stages of the river the amount of water in the ditch should be taken out from the measured discharge in making curve and rating table and should then be added to the discharge taken from the table.

On June 15, 1904, a gage was placed on the Farmers Mill ditch and read from that time until the station was temporarily abandoned, September 4, on account of fluctuations caused by the mill above and the building of a concrete diversion dam below the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Umatilla River at Pendleton, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
February 18	H. A. Yates	100	252	4.20	2.80	1,065
March 7	do	131	482	5.67	4.58	2,735
March 9	do	182	864	6.54	6.45	5,645
March 23	do	108	356	4.00	2.95	1,430
April 13	Brainard and Saxton	191	816	6.86	7.05	5,597
May 24	W. C. Sawyer	101	285	4.16	2.70	1,185
May 28	do	100	263	2.28	1.90	570 [b]
June 7	do	87	253	2.07	2.00	492 [c]
July 12	do	16	14.5	3.07	1.25	6 [d]
August 14 [a]	do	25	12	2.30	.95	28
August 14	do	28	12.5	2.30	.95	28.5

[a] Wading 800 feet above station.
[b] 30 second-feet subtracted for canal.
[c] 33 second-feet subtracted for canal.
[d] 40 second-feet subtracted for canal.

Mean daily gage height, in feet, of Umatilla River at Pendleton, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.75	1.90	2.90	4.00	3.38	1.82	1.25
2	1.70	1.85	2.95	4.15	3.18	1.92	1.25
3	1.65	1.80	2.85	4.72	3.42	2.05	1.41
4	1.65	1.80	2.80	4.52	3.42	2.08	1.25
5	1.65	1.90	2.80	4.28	3.30	2.05	1.30
6	1.60	1.90	3.18	5.22	3.10	2.05	1.20
7	1.60	1.90	4.62	4.75	3.10	2.02	1.20
8	1.67	1.85	6.60	4.35	2.95	2.00	1.20
9	1.68	1.80	6.35	4.85	2.98	1.92	1.20
10	1.75	1.70	5.08	5.80	3.10	1.90	1.20
11	2.15	1.70	4.32	6.70	3.12	1.85	1.20
12	2.37	1.75	3.75	6.60	3.15	1.75	1.25
13	2.95	1.75	.....	7.14	3.15	1.70	1.15
14	2.90	1.70	3.10	7.04	3.08	1.65	.....
15	3.23	1.72	3.40	6.74	3.00	1.55	.....
16	3.17	3.05	3.20	5.90	2.80	1.50	.....
17	3.05	3.02	3.18	5.32	2.78	1.50	.....
18	2.95	2.80	3.32	5.08	2.75	1.45	.....
19	2.72	2.70	3.35	5.45	2.90	1.45	.....
20	2.50	2.60	3.50	5.75	2.95	1.38	.....
21	2.35	2.50	3.45	5.28	2.95	1.30	.....
22	2.53	2.82	3.20	4.85	2.75	1.30	.....
23	2.87	3.30	3.05	4.20	2.70	1.30	.....
24	2.85	3.28	2.75	3.72	2.65	1.30	.....
25	2.60	3.20	2.60	3.65	2.38	1.30	.....
26	2.55	3.18	2.50	4.28	2.20	1.30	.....
27	2.35	3.30	2.50	4.52	2.10	1.25	.....
28	2.15	3.10	2.60	4.40	1.95	1.25	.....
29	2.05	2.92	3.90	4.20	1.85	1.25	.....
30	2.00	.....	5.10	3.72	1.78	1.25	.....
31	1.95	.....	4.45	.....	1.75	.....	.....

UMATILLA RIVER AT YOAKUM, OREG.

This station was established May 5, 1903, by N. S. Dils. It is located one-half mile east of Yoakum station of the Oregon Railroad and Navigation Company, at what is known as the Yoakum wagon bridge. The original gage is a vertical split rail spiked to the face of the south abutment on the upstream side. On September 5, 1903, a new gage, consisting of a 2 by 6 inch timber, 14 feet long, was spiked in a vertical position to the right abutment on the opposite side of the river from the original gage. The new gage was necessary to obtain gage readings at low stages. It is set at the same datum as the original gage and both gages read the same. During 1904 readings have been made once each day by Luther Dehaven. Discharge measurements are made from the single-span wagon bridge at which both gages are located. The initial point for soundings is the end of the lower chord of the upstream truss on the left bank. The channel is straight for 1,000 feet above and below the station. The current

is swift and has a well-distributed velocity. Both banks are high and are composed of gravel. The right bank will not overflow. The left bank will overflow only at extreme flood stages. The bed of the stream is composed of gravel and is permanent. There is but one channel at all stages. The bench mark is a 60-penny nail and two 8-penny nails driven side by side into the second timber from the top of the left abutment near the old gage. The elevation of the bench mark is 13.00 feet above the zero of both gages.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Umatilla River at Yoakum, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 30	H. A. Yates	76	530	9.80	8.50	5,215
April 12	do	76	616	10.67	9.65	6,575
April 28	W. C. Sawyer	76	430	7.26	7.15	3,116
May 20	do	76	316	4.60	5.55	1,453
May 31	do	76	195	2.46	4.30	480
July 31	do	76	141	.98	3.36	138
September 3	do	72	99	.41	2.84	40

Mean daily gage height, in feet, of Umatilla River at Yoakum, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.40	4.50	6.00	.....	6.30	4.30	3.10	2.80	2.80	3.00	3.20	3.20
2	4.30	4.50	5.90	.....	6.60	4.30	3.10	2.80	2.80	3.00	3.20	3.20
3	4.30	4.40	5.80	.....	6.60	4.30	3.10	2.70	2.80	3.00	3.20	3.20
4	4.30	4.30	5.80	.....	6.60	4.30	3.80	2.70	2.80	3.00	3.20	3.20
5	4.30	4.20	5.80	.....	6.50	4.30	3.70	2.70	2.90	3.00	3.20	3.20
6	4.30	4.20	6.00	.....	6.40	4.40	3.60	2.70	2.90	3.00	3.20	3.20
7	4.30	4.30	7.10	.....	6.30	4.30	3.60	2.70	2.90	3.00	3.20	3.20
8	4.40	4.50	9.70	.....	5.80	4.30	3.50	2.70	2.90	3.00	3.20	3.20
9	4.40	4.50	9.00	.....	5.80	4.20	3.50	2.70	2.90	3.00	3.20	3.20
10	4.50	4.50	8.70	.....	6.00	4.10	3.50	2.70	2.90	3.00	3.20	3.20
11	4.90	4.60	8.20	.....	6.00	4.00	3.40	2.70	2.90	3.20	3.20	3.20
12	5.10	4.60	7.00	.....	5.90	4.00	3.50	2.70	2.90	3.10	3.20	3.20
13	5.60	4.60	6.40	.....	5.80	4.00	3.40	2.70	2.90	3.10	3.20	3.20
14	5.70	4.60	6.30	.....	5.60	3.90	3.40	2.70	2.90	3.20	3.20	3.20
15	6.10	4.70	6.50	.....	5.50	3.80	3.40	2.70	2.90	3.30	.....	3.20
16	6.00	6.00	6.40	.....	5.40	3.80	3.40	2.70	2.90	3.30	3.20	3.20
17	6.00	6.10	6.30	.....	5.40	3.60	3.40	2.70	2.90	3.40	3.20	3.20
18	5.90	5.90	6.40	.....	5.50	3.50	3.30	2.70	2.90	3.30	3.20	3.30
19	5.70	5.70	6.40	.....	5.50	3.40	3.30	2.70	2.90	3.30	3.20	3.30
20	5.60	5.50	6.40	.....	5.40	3.40	3.30	2.70	2.90	3.30	3.20	3.40
21	5.40	5.60	6.30	.....	5.40	3.40	3.20	2.70	3.00	3.30	3.20	3.40
22	5.20	6.20	6.20	.....	5.40	3.30	3.20	2.80	3.00	3.30	3.20	3.40
23	5.00	6.40	6.20	.....	5.20	3.30	3.10	2.80	3.30	3.20	3.20	3.40
24	5.30	6.50	6.20	.....	5.10	3.30	3.00	2.80	3.20	3.20	3.20	3.40

Mean daily gage height, in feet, of Umatilla River at Yoakum, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
25	5.40	6.40	6.10	.....	4.90	3.30	3.00	2.80	3.10	3.20	3.20	3.40
26	5.30	6.40	5.70	.....	4.70	3.30	3.00	2.80	3.00	3.20	3.20	3.40
27	5.10	6.30	5.70	.....	4.60	3.20	2.90	2.80	3.00	3.20	3.20	3.40
28	5.00	6.20	5.90	7.10	4.60	3.10	2.90	2.80	3.00	3.20	3.20	3.40
29	4.90	6.10	7.70	6.70	4.50	3.10	2.90	2.80	3.00	3.20	3.20	3.50
30	4.70	.....	8.40	6.60	4.40	3.10	2.80	2.80	3.00	3.20	3.20	3.70
31	4.70	.....	7.50	.....	4.40	.....	2.80	2.80	.....	3.20	.....	3.80

Rating table for Umatilla River at Yoakum, Oreg., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.70	30	4.20	457	5.60	1,475	7.00	2,971
2.80	41	4.30	510	5.70	1,568	7.20	3,217
2.90	53	4.40	567	5.80	1,663	7.40	3,469
3.00	65	4.50	628	5.90	1,760	7.60	3,730
3.10	78	4.60	691	6.00	1,859	7.80	3,995
3.20	95	4.70	758	6.10	1,960	8.00	4,270
3.30	116	4.80	827	6.20	2,064	8.20	4,551
3.40	141	4.90	899	6.30	2,170	8.40	4,837
3.50	170	5.00	973	6.40	2,279	8.60	5,133
3.60	201	5.10	1,050	6.50	2,389	8.80	5,434
3.70	235	5.20	1,131	6.60	2,501	9.00	5,741
3.80	272	5.30	1,214	6.70	2,615	9.50	6,541
3.90	313	5.40	1,299	6.80	2,731	10.00	7,382
4.00	358	5.50	1,386	6.90	2,850	10.50	8,252
4.10	406						

The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1904 and is fairly well defined. Above gage height 10.00 feet the rating curve is a tangent, the difference being 174 per tenth.

Estimated monthly discharge of Umatilla River at Yoakum, Oreg., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	1,960	510	1,046	64,320
February	2,389	457	1,264	72,710
March	6,871	1,568	2,730	167,900
April [a]			4,174	248,400
May	2,501	567	1,487	91,430
June	567	78	288	17,140
July	272	41	120	7,379
August	41	30	34.3	2,109
September	116	41	58.5	3,481
October	141	65	90.5	5,565
November	95	95	95.0	5,653
December	272	95	122	7,501
The year			959	693,500

[a] Discharge estimated April 1-27, inclusive.

UMATILLA RIVER NEAR UMATILLA, OREG.

This station was established October 21, 1903, by John H. Lewis. It is located about 2 miles above Umatilla, Oreg., and about one-fourth mile below the diversion dam of the Oregon Land and Water Company. This dam diverts water into an irrigation ditch on the left bank. The inclined gage is on the left bank 45 feet below the cable and is in two sections. Both sections are made of 2 by 6 inch timber fastened by bolts which are cemented into the rock. The lower section reads from 1.2 to 3.5 feet. The upper section reads from 3.5 to 10.8 feet. The gage is read every other day by B. V. Pompella. Gage readings are taken every day during floods. Discharge measurements are made by means of a $\frac{5}{8}$-inch wire cable, car, tagged wire, and stay wire. The cable has a span of 210 feet. The initial point for soundings is the zero mark on the tag wire, directly over the vertical portion of the left bank. The channel is straight for 500 feet above and for 1,000 feet below the cable. The current is swift. Both banks are high and rocky and will not overflow. The bed of the stream is composed of solid rock, free from vegetation, and permanent. The bench mark is the head of a bolt cemented in the solid rock $1\frac{1}{2}$ feet upstream from the gage rod. Its elevation is 10.30 feet above the zero of the gage. To obtain the total discharge of the river, the discharge of the irrigation ditch must be added to that of the river at the cable. The rapids just above Umatilla prevent

backwater from Columbia River from affecting the gage heights at the station.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of Umatilla River near Umatilla, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 18	J. H. Lewis	178	420	5.02	4.40	2,190
March 30	do	183	742	7.40	6.30	5,484
April 11	H. A. Yates	187	760	8.00	6.65	6,030
May 13	Murphy and Sawyer	175	317	4.78	4.00	1,507
August 13 [a]	W. C. Sawyer	20	8	0.78	1.86	7
October 24	do	50	40	1.58	2.42	62

[a] Made at different section.

Discharge measurements of Oregon Land and Water Company's ditch near Umatilla, Oreg., in 1904.

Date.	Discharge.	Date.	Discharge.
	Second-feet.		*Second-feet.*
March 18	0.0	May 13	12.4
March 30	0.0	October 24 [a]	13
April 11	15		

[a] Estimated.

Mean daily gage height, in feet, of Umatilla River near Umatilla, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.30	3.50	4.25				2.15		1.95	2.35		
2	3.30	3.40		5.40	4.55	3.20		2.20			2.35	2.55
3	3.30	3.40	4.20	5.50	4.40		2.15		2.00	2.35		
4	3.30	3.30		5.65		3.30		2.10			2.35	2.55
5	3.30	3.30	4.25	5.60	4.30	3.20	3.10		2.00	2.30		
6	3.20	3.30		5.50	4.25			2.05			2.35	2.55
7	3.20	3.40	4.80	5.90	4.25	3.15	3.00		2.00	2.15		
8	3.20	3.40		5.80	4.25	3.10		2.00			2.30	2.55
9	3.20	3.40	7.30		4.15	3.10	2.80		2.00	2.15		
10	3.30	3.40		6.00	4.05	3.05		2.00			2.35	2.55
11	3.50	3.30	5.45	6.60	4.20	3.00	2.70		2.00	2.30		
12	3.70	3.30		6.90	4.15	2.85		1.95			2.35	2.55
13	3.80	3.30	4.80	7.05	4.00	2.85	3.00		2.00	2.35		
14	4.10	3.30		7.40	4.00	2.80		1.90			2.35	2.55
15	4.00	3.30	4.75	7.65	3.95	2.80	2.60		2.20	2.45		
16	4.20	3.90		7.40	3.95			1.90		2.45	2.40	2.60
17	4.20	4.40	4.60	6.45	3.90	2.75	2.60		2.20			
18	4.10				3.85			1.90		2.45	2.35	2.60
19	4.10	4.20	4.40	5.40	3.85	2.70	2.55		2.20			

Mean daily height, in feet, of Umatilla River near Umatilla, Oreg., for 1904—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
20	4.00	.....	.....	.....	3.90	.....	.....	1.90	.....	2.45	2.40	2.60
21	3.90	4.00	4.40	5.80	3.80	2.60	2.50	.....	2.20	.....	.....	.....
22	3.80	.....	4.45	.....	.....	.....	.....	1.90	.....	2.45	2.35	2.65
23	3.70	4.40	4.40	5.20	3.80	2.50	2.50	.....	2.20	.....	.....	.....
24	3.70	.....	4.35	5.00	3.80	.....	.....	1.90	.....	2.40	2.40	2.65
25	3.80	4.30	4.35	.....	3.70	2.50	2.50	.....	2.40	.....	.....	.....
26	3.80	.....	4.20	4.20	3.60	.....	.....	1.95	.....	2.40	2.40	2.65
27	3.80	4.20	4.10	4.50	3.45	2.45	2.40	.....	2.35	.....	.....	.....
28	3.70	.....	4.00	4.60	3.35	.....	.....	1.95	.....	2.40	2.50	2.65
29	3.60	4.20	4.80	.....	3.25	2.30	2.25	.....	2.30	.....	.....	.....
30	3.60	.....	6.45	4.80	3.20	.....	.....	1.95	.....	2.30	2.50	2.65
31	3.50	.....	5.95	.....	3.15	.....	2.20	.....	.....	2.30	.....	.....

Rating table for Umatilla River near Umatilla, Oreg., from October 22, 1903, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.90	9	3.20	531	4.50	2,200	5.80	4,444
2.00	14	3.30	627	4.60	2,355	5.90	4,636
2.10	21	3.40	731	4.70	2,512	6.00	4,830
2.20	30	3.50	843	4.80	2,672	6.20	5,218
2.30	43	3.60	962	4.90	2,835	6.40	5,606
2.40	62	3.70	1,085	5.00	3,000	6.60	5,994
2.50	88	3.80	1,212	5.10	3,169	6.80	6,382
2.60	124	3.90	1,342	5.20	3,342	7.00	6,770
2.70	171	4.00	1,475	5.30	3,518	7.20	7,158
2.80	227	4.10	1,612	5.40	3,697	7.40	7,546
2.90	291	4.20	1,753	5.50	3,880	7.60	7,934
3.00	363	4.30	1,898	5.60	4,066	7.80	8,322
3.10	443	4.40	2,047	5.70	4,254	8.00	8,710

The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1903 and 1904. It is well defined between gage heights 1.85 feet and 6.15 feet. The table has been extended above 6.15 feet. Above gage height 6.00 feet the rating curve is a tangent, the difference being 194 per tenth.

Estimated monthly discharge of Umatilla River near Umatilla, Oreg., for 1903 and 1904.

Month.	Discharge in second-feet.[a]			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
October 22–31	171	124	134	2,658
November	2,512	88	810	48,200
December	1,753	531	1,102	67,760
1904.				
January	1,753	531	1,049	64,520
February	2,047	627	1,219	70,110
March	7,352	1,475	2,827	173,900
April	8,031	1,753	4,371	260,100
May	2,512	486	1,415	87,020
June	627	30	269	16,030
July	443	25	145	8,886
August	30	9	13	807
September	62	11	27	1,617
October	74	25	55	3,366
November	88	43	58	3,437
December	146	88	121	7,462
The year	8,031	9	964	697,200

[a] Discharge for missing gage heights interpolated.

M'KAY CREEK NEAR PENDLETON, OREG.

This station was established May 23, 1903, by E. I. Davis. It was located at the footbridge near the residence of C. W. Lyman, 2 miles west of Pendleton, Oreg. The gage was a vertical 1 by 6 inch board 11 feet long nailed to a post which is set in the bed of the stream and braced to a large poplar tree. It was about 200 feet north of C. W. Lyman's house and is about 150 feet below the footbridge, on the left bank. It was read twice each day by C. W. Lyman. Discharge measurements were made from the footbridge of 65-foot span, above the gage. The initial point for soundings was the end of the log, of which the bridge consists, on the right bank. The channel is straight for 150 feet above and 100 feet below the bridge. The current has a good velocity at ordinary stages. Both banks are high, not liable to overflow, and are without trees. There is but one channel at all stages. The bed of the stream is composed of gravel, free from vegetation, and permanent. The bench mark was a nail in a blaze on a root of the poplar tree to which the gage was braced. Its

elevation was 5.82 feet above the zero of the gage. The station was abandoned July 6, 1904.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of McKay Creek near Pendleton, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
March 5	H. A. Yates	40	126	3.40	2.20	434
March 11	do	42	150	4.90	3.05	740
April 12	do	43	182	6.00	3.90	1,100
June 2 [a]	W. C. Sawyer	16	14.5	1.73	1.22	25

[a] Made at different section.

Mean daily gage height, in feet, of McKay Creek near Pendleton, Oreg., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.55	1.50	2.00	3.35	2.00	1.15	0.90
2	1.45	1.50	2.00	3.30	2.00	1.25	.90
3	1.40	1.45	2.00	3.40	2.00	1.25	.90
4	1.40	1.40	2.00	3.40	1.95	1.20	1.60
5	1.40	1.50	2.20	3.28	1.90	1.20	1.45
6	1.40	1.50	2.25	3.80	1.90	1.20	1.30
7	1.40	1.50	3.20	3.40	1.85	1.20	.....
8	1.40	1.50	4.10	3.25	1.80	1.20	.....
9	1.50	1.50	3.95	3.80	1.75	1.20	.....
10	1.50	1.50	3.35	4.00	1.70	1.20	.....
11	1.70	1.50	3.00	3.80	1.70	1.20	.....
12	1.90	1.50	2.50	3.80	1.60	1.20	.....
13	2.00	2.35	2.45	3.80	1.60	1.20	.....
14	2.30	2.50	2.40	3.80	1.55	1.20	.....
15	2.40	2.50	2.40	3.55	1.55	1.10	.....
16	2.30	2.35	2.40	3.50	1.50	1.05	.....
17	2.15	2.20	2.40	3.30	1.50	1.00	.....
18	2.10	2.15	2.40	3.05	1.50	1.00	.....
19	2.00	2.00	2.40	3.00	1.45	1.00	.....
20	1.85	2.00	2.42	2.90	1.45	.97	.....
21	1.85	1.90	2.40	2.85	1.40	.95	.....
22	1.95	2.40	2.25	2.80	1.40	.90	.....
23	2.10	2.50	2.12	2.55	1.38	.90	.....
24	2.00	2.50	2.00	2.40	1.35	.90	.....
25	2.00	2.25	1.95	2.30	1.30	.90	.....
26	1.90	2.20	1.90	2.30	1.28	.90	.....
27	1.85	2.15	1.90	2.25	1.25	.90	.....
28	1.75	2.10	2.10	2.20	1.20	.90	.....
29	1.70	2.00	3.35	2.10	1.20	.90	.....
30	1.60	.....	4.25	2.00	1.20	.90	.....
31	1.55	.....	3.40	.....	1.18	.....	.....

JOHN DAY RIVER AT M'DONALD, OREG.

This station was established December 16, 1904, by W. C. Sawyer. It is located at the ferry at McDonald, 16 miles above the mouth of the river, and 18 miles southwest of Arlington, Oreg. An inclined staff gage in two sections is fastened to old bridge timbers 183 feet upstream from the ferry cable. The lower section reads from 1 to 2 feet; the upper section reads from 2 to 11 feet. The gage is read once each day by William Murray. Discharge measurements are made by means of a car suspended from the ferry cable. The car is provided with steel snatch blocks and lever for passing the ferry traveler. The initial point for soundings is the face of the support on the right bank. The channel is straight for one-half mile above and below the cable. The current is swift. Both banks are high, free from vegetation, and do not overflow. The bed of the stream is composed of clean sand and gravel, and is slightly shifting. There is but one channel at all stages. Bench mark No. 1 is the top of the corner stone under the southeast corner of barn near the gage. Its elevation is 15.32 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurements of John Day River at McDonald, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
October 26	W. C. Sawyer	263	602	0.96	2.00	580
December 16	do	262	627	.90	1.98	570

Mean daily gage height, in feet, of John Day River at McDonald, Oreg., for 1904.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		1.95	12		1.95	22	1.90	2.00
2		1.95	13		2.01	23	1.90	2.00
3		1.95	14	1.70	2.00	24	1.95	2.00
4		1.95	15	1.70	2.00	25	1.95	2.00
5		1.95	16	1.70	1.95	26	1.95	2.00
6		1.90	17	1.80	2.00	27	1.95	1.85
7		1.80	18	1.80	2.00	28	1.95	1.80
8		1.70	19	1.90	1.95	29	1.95	1.65
9		1.70	20	1.90	1.90	30	1.95	1.85
10		1.80	21	1.90	1.95	31		1.90
11		1.90						

DESCHUTES RIVER NEAR BEND, OREG.

This station was established December 22, 1904, by W. C. Sawyer. It is located at the wagon bridge known as Sizemore's bridge, 1¼ miles south of Bend, Oreg. A plain staff gage, graduated to feet and tenths, is spiked vertically to the sixteenth bent of the bridge, 335 feet from the initial point for soundings. It is read once each day by Dr. W. S. Nichol, who is paid by the Deschutes Irrigation and Power Company. Discharge measurements are made from the downstream side of the bridge to which the gage is attached. The initial point for soundings is a point marked with black paint at the west end of the bridge, downstream side. The channel is straight for 300 feet above and below the station. The current is swift, and both banks are high. The left bank is subject to overflow at extreme high water. The bed of the stream is composed of rock and gravel, free from vegetation, and is permanent. There is but one channel at all stages. The bench mark is a copper bolt cemented in a large bowlder near the edge of the water, about 100 feet above the east end of the bridge. Its elevation is 5.20 feet above the zero of the gage.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Discharge measurement of Deschutes River near Bend, Oreg., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
December 21	W. C. Sawyer	348	834	2.89	2.00	2,412

Mean daily gage height, in feet, of Deschutes River near Bend, Oreg., for 1904.

Day.	Dec.	Day.	Dec.	Day.	Dec.
22	2.0	26	2.0	29	2.0
23	2.0	27	1.9	30	2.0
24	2.0	28	1.9	31	2.0
25	2.0				

DESCHUTES RIVER (EAST FORK) AT ODELL, OREG.

This station was established December 25, 1904, by W. C. Sawyer. It is located at the county wagon bridge at Odell, Oreg. A plain staff gage, graduated to feet and tenths, is spiked vertically to logs projecting from a milk house belonging to the observer. It is read once each day by Charles Graves. Discharge measurements are made from the bridge at all ordinary stages. At extreme high water a foot log below the bridge is used. The initial point for soundings at the

bridge is a 10-penny nail driven into a log at the south end of the bridge, downstream side. The initial point at the foot log is a 10-penny nail driven into the north end of the foot log. The channel is curved. The current is swift. Both banks are low and clean. The left bank is liable to overflow at high water. The bed of the stream is composed of gravel and sand, free from vegetation, and is permanent. There are two or more channels at the bridge during high water and one at low and ordinary stages. There is but one channel at all stages at the foot log. The bench mark is a 60-penny nail in the base of a jack-pine tree used for gate post in the yard fence of the observer. Its elevation is 7.87 feet above the zero of the gage rod.

The observations at this station during 1904 have been made under the direction of John T. Whistler, district engineer.

Mean daily gage height, in feet, of Deschutes River (East Fork) at Odell, Oreg., for 1904.

Day.	Dec.	Day.	Dec.	Day.	Dec.
26	2.5	28	2.8	30	2.7
27	2.5	29	2.7	31	2.7

MISCELLANEOUS MEASUREMENTS IN COLUMBIA RIVER DRAINAGE BASIN.

The following discharge measurements were made in Columbia River drainage basin in 1904 under the direction of D. W. Ross, C. C. Babb, John T. Whistler, and T. A. Noble, district engineers:

Miscellaneous measurements in Idaho in 1904.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
Aug. 31	Aster Creek	"Soldier Crossing"		31	0.70		20.4
Mar. 20	Clearwater River	Railway bridge between Lapwai and Potlatch Junction.	594	3,493	5.44		19,018
July 19	Big Payette	At outlet of Big Payette Lake.					812
June 28	Conant Creek	Near Squirrel		29	1.94		56
June 12	Fish Creek	10 miles from Carey, above all canals.					49
Aug. 31	Lewis Lake Outlet	"Soldier Crossing," near falls.		161	1.3		220
Aug. 30	Shoshone Lake Outlet.	3 miles above Lewis Lake		169	1.1		183
Aug. 26	Snake River (Henry Fork).	Ford on Yellowstone Park road.		48	1.2		60
Aug. 17	Snake River (North Fork).	Island Park bridge		414	2.4		1,000
Sept. 16	Spokane River	Old Fort Sherman at outlet of Cœur d'Alene Lake.	450	1,043	.93	[a] 2,119	1,969

[a] Elevation of water surface above sea level.

Tributaries of the South Fork of Snake River, north side, from Sunnydell, Idaho, to Wyoming State line.

Date.	Stream.	Discharge.	Remarks.
Aug. 10	Lyman, or Lyon, Creek	0.4	Low. Above Sunnydell. Water rights disputed. Drainage area 36 miles.
Aug. 10	Hawley Springs	.8	Normal. Below Heise P. O. ½ mile.
Aug. 10	Kelly Creek	.7	Low. Above Heise 1 mile. Used on Kelly farm.
July 28	Rainy Creek	36	Low. In Swan Valley, 5 miles below Irwin. Entire summer flow used. Water rights in dispute. Gaged above all canals. Drainage area 70 miles.
July 29	Palisade Creek	106	Low. Gaged above all canals. In Swan Valley, 5 miles above Irwin. Drainage area 80 miles.
July 29	Sheep Creek	3.3	Low. In Swan Valley, 5 miles above Irwin. Flow taken by Tolman's ditch.
July 29	Elk Creek	105	Low. In Grand Valley, near Rosa. Gaged below all ditches.
July 30	Indian Creek	34	Low. In Grand Valley, near Rosa. Gaged below all canals. Trouble over water rights. Highest creek up river on north side used for irrigation in Idaho. Drainage area 50 miles.

Tributaries of the South Fork of Snake River, south side, from Wyoming State line to Poplar, Idaho.

Date.	Stream.	Discharge.	Remarks.
July 30	Williams Creek	1.3	Low. Below McCoy Creek 2 miles. Used for irrigation.
July 31	Edwards Creek	1.5	Low. Below McCoy Creek 5 miles. Entire summer flow used.
July 31	Cabin Creek	1.0	Low. Entire summer flow used.
July 31	Deer Creek	1.0	Do.
July 31	Summit Creek	1.3	Do.
July 31	Alder Creek	.7	Low. In Swan Valley, 15 miles below McCoy Creek. Entire summer flow used.
July 31	Dry Hollow Creek	.3	Low. Entire summer flow used.
July 31	Porcupine Creek	1.7	Do.
July 31	Deer Creek	1.8	Do.
Aug. 1	Indian Creek	3.0	Do.
Aug. 1	Squaw Creek	.7	Do.
Aug. 1	Fall Creek	23.9	Low. In Swan Valley. Used for irrigation. Drainage area 45 miles.
Aug. 1	Pritchard Creek	3.3	Low. In Conant Valley. Used for irrigation.

Tributaries of the South Fork of Snake River, south side, from Wyoming State line to Poplar, Idaho—Continued.

Date.	Stream.	Discharge.	Remarks.
Aug. 2	Garden Creek	1.0	Low. Entire summer flow used for irrigation.
Aug. 2	Granite Creek	.8	Do.
Aug. 2	Antelope Creek	1.8	Low. Entire summer flow used for irrigation. Drainage area 35 miles.
Aug. 2	Little Pine Creek	.3	Low. Filings have been made on flow.

Tributaries of the North Fork of Snake River above Marysville, Idaho.

Date.	Stream.	Discharge.	Remarks.
Aug. 15	Hill Creek	0.3	Low. North bank Snake opposite Marysville, near ford. Entire summer flow used.
Aug. 17	Thurman Creek	18	Bank full; spring fed. 30 miles from Marysville. Used for irrigation.
Aug. 17	Thurman Springs	.2	Normal. Used for irrigation.
Aug. 17	West Bald Cabin Springs	.2	Do.
Aug. 17	East Bald Cabin Springs	1.5	Do.
Aug. 17	Green Springs	.6	Do.
Aug. 17	Osborn Creek	6.0	Bank full; spring fed. Used for irrigation.
Aug. 18	Blue Springs	3.6	Normal. Water rights claimed.
Aug. 18	Tom Creek	.5	Normal. Used for irrigation. Flows into Buffalo Creek.
Aug. 18	Grizzly Spring	5.3	Normal. Used for irrigation. Tributary to Shotgun Creek.
Aug. 19	Ice House Creek	9.0	About normal; spring fed. Used for irrigation. Tributary to Shotgun Creek. Drainage area 35 miles.
Aug. 20	Willow Creek	3.0	Low. Used for irrigation. Tributary of Shotgun Creek. Ownership disputed. Drainage area 20 miles.
Aug. 20	Caldwell Spring No. 1	.5	Normal. In Icehouse Park. Upper watershed of Icehouse Creek. Used for irrigation and domestic purposes.
Aug. 20	Caldwell Spring No. 2	.3	Normal. Same as spring No. 1.
Aug. 21	Taylor Creek	.6	Low. Tributary of Shotgun Creek. Used for irrigation. Ownership disputed.
Aug. 22	Sorenson Spring	.8	Low. Rises between Taylor and Sheridan creeks above Sheridan ranch. Used for irrigation. Ownership disputed.
Aug. 22	Shotgun Creek	68	Gaged at Trude's bridge, about 1 mile above mouth. Drainage area 145 miles.

Tributaries of Henry Fork, a tributary of North Fork of Snake River, east bank, going upstream.

Date.	Stream.	Discharge.	Remarks.
Aug. 27	Meadow Creek	8.8	Bank full; spring fed. Used by ranchers.
Aug. 22	Pine Creek	.9	Mid height. Entire summer flow used for irrigation.
Aug. 23	Coolie Creek	12.3	Mid height. Used for irrigation.
Aug. 23	Snow Water Creek	.2	Low. Entire summer flow used.
Aug. 23	Bear or Little Spring	.5	Normal. Used for irrigation.
Aug. 23	Canyon Creek	.8	Do.
Aug. 23	Thompson Springs	5.0	Do.
Aug. 23	Garner Spring	.9	Do.
Aug. 23	Jessie Creek	3.0	Low.
Aug. 24	Twin Creek	6.8	Below normal.

Tributaries of Henry Lake, Idaho.

Date.	Stream.	Discharge.	Remarks
Aug. 24	Howard Creek	11	Low. Used for irrigation.
Aug. 24	Tahgee Creek	19	Do.
Aug. 25	Whitman Spring	1.7	Normal. Used to supply fish pond.
Aug. 25	Rock Springs	.7	Normal. Used for irrigation.
Aug. 25	Howe Creek	.7	Normal. Owned by Henry Lake Shooting Club. Used by rancher to make proof on desert entry.
Aug. 25	Sherwood Springs	1.2	Normal. Used for irrigation.
Aug. 25	Canyon Creek	.6	Low. Used for domestic purposes.
Aug. 25	Oswald Creek	.3	Low. Used for irrigation.
Aug. 25	Big Spring	1.2	Normal. Used for irrigation. Tributary of Timber Creek.
Aug. 25	Golf Spring	.7	Normal.
Aug. 25	Timber Creek	1.0	Gaged above confluence with Oswald, Big Spring, and Golf Spring creeks. Used for irrigation.
Aug. 26	Johnson Creek	3.2	Rises on Sherman ranch. Used on Sherman and Staley ranches.
Aug. 26	Duck Creek	9.6	Used on Sherman ranch.
Aug. 26	Rock Creek	6.4	Do.
Aug. 26	Hope Creek	2.4	Do.

Miscellaneous measurements in Montana in 1904.

SUBDRAINAGE BASIN OF MISSOULA RIVER.

Date.	Stream.	Locality.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Sq. feet.	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
May 21	New Hedge ditch	Grantsdale	19	2.68	2.35	[a] 51
Aug. 26	do	do	27	4.00	3.15	[a] 107
May 21	Republican ditch	do	37	2.35	2.30	[a] 86
Aug. 26	do	do	35	3.00	2.60	[a] 104
May 19	Rattlesnake Creek	Missoula	111	5.82		646

[a] Measurements made directly above the United States Geological Survey gaging station at Grantsdale, on Bitterroot River.

Miscellaneous measurements in Oregon in 1904.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
			Feet.	*Square feet.*	*Ft. per second.*	*Feet.*	*Second-feet.*
July 15	Abiqua Creek	Highway bridge, near Silverton.				1.2	82
Apr. 9	Bully Creek	Bridge at Westfall	25	58	5.64		324
Apr. 11	do	do	25	92	6.95		643
July 22	Crescent Creek	Outlet Crescent Lake	105	303	.64		195
Aug. 1	do	do	105	279	.60		166
July 23	do	Above Deschutes River	34	71	2.70		192
Sept. 12	Davis Creek	½ mile above mouth	98	191	1.50		287
Aug. 6	Deschutes River	½ mile below Crescent Creek	72	97	2.25		219
July 21	Deschutes River, East Branch.	Odell	22	16	2.10		97
Aug. 21	do	do	24	38	1.81		69
Sept. 16	do	Rosland	65	120	2.05		246
July 23	Deschutes River, West Branch.	Royce's ranch, T. 24 S., R. 7 E.	24	27	3.22		86
Sept. 14	do	Sec. 8, T. 21 S., R. 8 E	104	514	1.10		566
July 16	Molalla River[a]	Highway bridge, near Canby.				.8	247
July 28	Outlet	Odell Lake	54	54	2.37		128
Oct. 25	Rock Creek	France	4	1.3	.73		.9
July 30	Rogue River[a]	Highway bridge, at Grants Pass.				.9	2,254
Nov. 2	Santiam River[a]	Scio ferry, near Marion				.1	726
July 15	Silver Creek[a]	Union Light and Power Co. station, near Silverton.				.8	28
Aug. 7	do	do				.0	11
Mar. 10	Wildhorse Creek	Pendleton	34	114	2.55		290
Oct. 20	Willamette River[a]	Highway bridge, at Eugene				.4	1,370

[a] Miscellaneous measurements furnished to the United States Geological Survey by Mr. J. H. Cunningham, civil and hydraulic engineer, Portland, Oreg.

Miscellaneous measurements in Washington, 1904.

Date.	Stream.	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge
			Feet.	*Square feet.*	*Ft. per second.*	*Feet.*	*Second feet.*
Aug. 27	American River	Mouth near Niles		66	1.64		108
Aug. 26	Bumping River	Bumping Lake		110	1.05		116
Sept. 21	Cabin Creek	Near Easton		6.2	1.11		6.9
Sept. 22	Clealum River	2 miles above Lake Clealum		155	1.33		206
Oct. 17	Colville River	Kettle Falls	125	257	.82	15.7	210
Apr. 6	Cottonwood Creek	Rock Lake	21	18.9	1.69		32
May 7	do	do	4	1.9	2.12		4.1
June 24	do	do	1.4	.7	.90		.6
Mar. 21	Crab Creek	3½ miles west of Odessa	24	125	3.29		410
Mar. 21	do	Odessa	34	126	3.21		403
Mar. 23	do	Railway bridge east of Stratford.	84	317	2.08		661
Aug. 16	do	Krupp	18	12.7	.66		8.4
Mar. 22	East Channel Crab Creek.	Blithe's ranch	8.7	10.4	3.46		36
Mar. 22	West Channel Crab Creek.	do				(a)	9.9
Mar. 30	Hangman Creek	Spokane	71	607	2.86	10.3	1,739
Oct. 21	Kettle River	Orient	108	1,185	.57	24.36	674
June 14	Pechastin Creek	Wenache	46	95	5.46		521
Sept. 16	Spokane River	Greenacres	254	1,181	.62		727
Mar. 19	Outlet Tule Lake	Tule Lake	6.1	27.1	1.72		46.7
June 14	Wenache River	Pechastin	237	1,542	6.35		10,830
June 16	do	Wenache		2,638	4.98		13,140
Sept. 21	Yakima River	Clealum	187	223	1.98		442
Sept. 23	do	Thorp	153	191	2.70		515
Mar. 19	Asotin Land and Water Co.'s canal.	Power plant, Asotin	1.8	.6	1.30		.8
Mar. 26	do	do	1.8	.6	1.27		.8
July 8	Clark canal	North Yakima		4.6	1.01		4.7
June 6	Kiona Water Supply Co.'s canal.	Kiona		14.1	1.31		18.5
Mar. 19	Lewiston Water Power Co.'s canal.	Above power pipe, Clarkson.	6	9	4.06	4.52	37
Mar. 26	do	do	6.2	11.3	2.63		30
July 1	do	do	5.8	11.3	3.76		43
July 1	do	Below power pipe, Clarkson	5.8	5.8	2.83		16.3
Aug. 5	Olsen canal	Ellensburg		11.6	1.23		14.3
June 30	Rhodenbach Schuler canal.	North Yakima		3.1	1.02		3.2
July 20	do	do		3.6	1.34		4.8
Aug. 9	Taylor canal	do		7.5	1.23		9.2
Sept. 19	do	do		14.3	.81		12.9
June 15	Wenache Canal Co.'s canal.	Pechastin	14	33	1.62		60
July 26	do	Cashmere	7	13.7	3.08		42
July 8	Lowry canal	North Yakima		11.9	1.21		14.5
July 2	Wide Hollow wasteway.	do		24	1.85		44
Aug. 1	do	do		28	1.01		28

[a] Weir.

PUGET SOUND DRAINAGE BASIN.

For convenience in arrangement, the smaller rivers which have their headwaters on the western slope of the Cascade Range and which flow into Puget Sound north of Seattle have been grouped as the Puget Sound drainage. Of these, White River has its source near Mount Rainier and flows into Puget Sound near Seattle, Wash. Cedar River is a tributary of Black River. Snoqualmie and Skykomish rivers unite to form the Snohomish, which flows into the Sound about 10 miles beyond the junction, near Everett, Wash. The Stilaguamish lies north of the Skykomish and has a parallel course. The results of the data collected in Puget Sound drainage basin are given on the following pages:

CEDAR RIVER NEAR RAVENSDALE, WASH.

This station is located at the intake of the Seattle waterworks and is 15 miles below Cedar Lake, 4 miles from the Northern Pacific Railway at Ravensdale and 6 miles from the Columbia and Puget Sound Railway at Maple Valley. The station was established September 27, 1902, by T. A. Noble. The gage is a plain staff graduated to feet and hundredths, to which is attached a hook gage and vernier reading to thousandths. When this gage reads zero the hook is level with the crest of the dam. It is fastened securely to the head gates above the dam, and is read daily by George Landsburg. The bench mark is the crest of the dam. The elevation, from city levels, of the south end is 535.831 feet and of the north end 535.840 feet. The gagings at this station are made at two points. The first is 142 feet below the dam, where the cross section is small, the current rapid, and suitable for gaging the stream at stages below 1 foot on the gage. The measurements at this point are made from a cable. The initial point for soundings is on the right bank. The channel is straight. The right bank is steep, the left bank has a sloping gravelly beach, and the bed of the stream is rocky. At all stages of the river above 1 foot on the gage the measurements are made from a cable located 600 feet above the dam, where the cross section is large and suitable for gaging the higher stages of the river. The initial point for soundings is a spike driven into the top of a hemlock stump about 12 inches in diameter near the edge of the water. The right bank is a sloping sandy beach; the left bank is steep and of hardpan formation. The bed is permanent—rocky near the right bank, and of sand and gravel near the left bank.

To the discharge measurements made below the dam should be added the amount of water flowing into the gravity system which supplies the city of Seattle. This varies from 34 to 37 second-feet. The discharge of this pipe line was measured during the winter of

1901–2 by T. A. Noble, and the results have been published in Volume XLIX, page 112, Transaction of the American Society of Civil Engineers.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Discharge measurement of Cedar River near Ravensdale, Wash., in 1904.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Ft. per sec.*	*Feet.*	*Sec.-feet.*
August 23	G. F. Harley	73	105	1.23	0.45	[a] 166

[a] Gaged below the dam; 36 second-feet added for city pipe.

Mean daily gage height, in feet, of Cedar River near Ravensdale, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.53	1.68	1.20	1.21	1.90	1.49	1.36	0.69	0.46	0.41	0.38	1.45
2	1.50	1.62	1.17	1.19	1.78	1.54	1.36	.58	.44	.40	.38	1.33
3	1.48	1.58	1.16	1.20	1.65	1.66	1.33	.52	.43	.40	.38	1.19
4	1.50	1.59	1.18	1.19	1.61	1.77	1.29	.53	.43	.40	.37	1.11
5	1.46	1.56	1.30	1.41	1.54	1.77	1.28	.50	.43	.41	.37	1.10
6	1.42	1.55	1.38	1.41	1.51	1.71	1.22	.51	.42	.40	.38	.90
7	1.40	1.59	1.61	1.37	1.60	1.63	1.24	.50	.43	.39	.43	.92
8	.90	1.44	1.65	1.34	1.56	1.49	1.22	.60	.45	.39	.42	.90
9	.94	1.39	1.21	1.36	1.54	1.35	1.19	.49	.47	.40	.41	.89
10	1.75	1.37	1.52	1.43	1.51	1.39	1.16	.49	.44	.39	.39	.88
11	1.66	1.33	1.49	1.41	1.51	1.36	1.19	.49	.43	.43	.37	.88
12	1.98	1.24	1.45	1.66	1.49	1.33	1.10	.49	.58	.41	.37	.92
13	2.18	1.29	1.43	1.77	1.48	1.33	1.07	.48	.58	.40	.37	1.04
14	2.38	1.28	1.40	1.81	1.50	1.36	1.06	.48	.55	.39	.37	1.33
15	2.66	1.28	1.38	1.81	1.49	1.40	1.04	.47	.45	.38	.38	2.15
16	2.54	1.26	1.36	1.93	1.49	1.67	1.01	.47	.42	.42	.40	2.10
17	2.33	1.24	1.34	1.94	1.49	1.55	.91	.46	.42	.44	.43	2.07
18	2.17	1.23	1.34	1.95	1.52	1.54	.90	.46	.41	.42	.54	1.96
19	1.96	1.20	1.32	1.99	1.69	1.54	.90	.45	.42	.41	.68	2.23
20	1.88	1.18	1.32	2.00	1.72	1.50	.90	.45	.60	.40	1.09	2.09
21	1.79	.91	1.28	2.22	1.66	1.49	.81	.44	.56	.39	1.48	1.97
22	1.91	1.06	1.26	2.20	1.75	1.48	.70	.45	.56	.38	1.29	1.90
23	1.89	1.37	1.24	2.06	1.80	1.49	.61	.45	.55	.38	.94	1.74
24	1.90	1.34	.89	1.93	1.79	1.48	.82	.44	.52	.38	.97	1.51
25	1.84	1.30	1.20	1.82	1.72	1.46	.81	.44	.49	.37	1.26	1.37
26	1.88	1.28	1.20	1.82	1.63	1.45	.79	.43	.46	.38	1.31	1.26
27	1.84	1.26	1.16	1.84	1.60	1.43	.77	.43	.44	.36	1.35	1.18
28	1.81	1.24	1.21	1.89	1.57	1.40	.78	.45	.42	.37	1.57	1.16
29	1.76	1.23	1.25	2.06	1.56	1.39	.76	.48	.41	.37	1.64	1.62
30	1.72	.....	1.26	2.01	1.57	1.38	.74	.45	.40	.38	1.53	1.75
31	1.68	.....	1.24	.....	1.57	.....	.72	.43	.....	.38	.....	1.67

Rating table for Cedar River near Ravensdale, Wash., from September 27, 1902, to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.4	177	1.4	795	2.4	1,640	3.8	3,300
.5	235	1.5	861	2.5	1,750	4.0	3,540
.6	294	1.6	927	2.6	1,860	4.2	3,780
.7	354	1.7	995	2.7	1,980	4.4	4,020
.8	414	1.8	1,065	2.8	2,100	4.6	4,260
.9	476	1.9	1,145	2.9	2,220	4.8	4,500
1.0	538	2.0	1,235	3.0	2,340	5.0	4,740
1.1	600	2.1	1,335	3.2	2,580	5.2	4,980
1.2	664	2.2	1,435	3.4	2,820	5.4	5,220
1.3	729	2.3	1,535	3.6	3,060	5.6	5,460

The above table is applicable for open-channel conditions only. It is based on 13 discharge measurements made during 1902–1904. It is fairly well defined to 2.70 feet gage height. The table has been extended above 2.7 feet. The rating table gives discharge at the upper section, above the intake of Seattle water-supply system.

Estimated monthly discharge of Cedar River near Ravensdale, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	1,932	476	1,099	67,580
February	981	482	757	43,540
March	961	470	732	45,010
April	1,455	658	1,021	60,750
May	1,145	848	933	57,370
June	1,044	749	858	51,060
July	769	300	541	33,260
August	348	194	226	13,900
September	294	177	217	12,910
October	200	154	174	10,700
November	954	160	387	23,030
December	1,385	464	835	51,340
The year	1,932	154	648	470,400

SKYKOMISH RIVER (SOUTH FORK) NEAR INDEX, WASH.

This station was established October 6, 1902, by T. A. Noble. It is located about 2 miles above Index and about 300 feet from the railroad track. The gage is a plain staff graduated to feet and tenths. A hook gage is used for reading to hundredths of a foot. Readings are made daily by Louis G. Heybrook. The gage is fastened by means of plugs driven in drill holes in the solid rock. The bench

mark is a cross cut in the rock about 6 feet above low water and 40 feet downstream from the gage. Its elevation, as obtained from the Great Northern Railway, is 679.158 feet. The elevation of the zero of the gage is 669.926 feet. The initial point for soundings is on the left bank at a plug driven in the solid rock 10 feet from the edge of stream at low water. The gagings are made from a cable. The channel is straight for 500 feet above and 300 feet below the station. Both banks are of solid rock and are not liable to overflow. The bed of the stream is of sand and gravel, not liable to change except near the left bank, where the sand shifts at high water. This does not cause any important change in the cross section. This station is 300 feet upstream from Sunset Falls, where the river plunges down a solid granite ledge with a slope of about two horizontal to one vertical. The ledge answers the purpose of a spillway in regulating the flow of the river at the gaging station, since the water has a free discharge and a permanent bed just below the station.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Skykomish River (South Fork) near Index, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.05	2.60	2.05	2.45	5.90	6.55	7.00	2.85	1.20	1.30	1.40	5.30
2	2.20	2.50	1.95	2.80	5.40	6.70	6.50	2.85	1.20	1.10	1.65	4.55
3	2.80	2.65	2.00	2.80	5.40	7.90	6.65	2.60	1.15	1.60	1.90	4.00
4	3.20	2.70	1.90	2.85	5.45	7.35	6.10	2.60	1.30	.95	1.55	3.55
5	3.10	2.85	2.30	3.85	5.60	7.95	6.60	2.55	1.35	.90	1.40	3.30
6	3.00	2.85	4.20	4.60	4.90	8.00	6.35	2.50	1.40	.80	1.30	3.00
7	3.70	2.70	7.30	3.90	5.00	6.50	6.10	2.45	1.40	.70	2.25	2.85
8	4.40	2.50	7.30	3.50	4.60	5.80	5.60	2.40	1.40	.65	2.60	2.75
9	4.50	2.40	5.90	4.15	4.40	6.40	5.60	2.15	1.40	.60	1.95	2.50
10	4.10	2.20	5.75	5.80	4.60	6.00	5.65	2.00	1.65	.55	1.70	2.40
11	5.00	2.15	4.80	6.95	4.55	5.60	5.35	1.90	1.80	1.60	1.35	2.85
12	5.00	2.20	3.40	8.25	4.90	6.05	5.10	1.85	1.00	2.00	1.20	2.80
13	9.50	2.10	3.25	9.45	5.60	6.10	4.35	1.80	.95	1.20	1.15	3.30
14	10.60	2.00	3.15	9.60	6.55	7.30	3.90	1.85	.95	1.40	1.15	8.80
15	7.50	1.90	2.95	7.95	6.10	7.35	4.10	1.85	.90	.95	2.80	9.10
16	6.35	1.85	2.90	7.65	5.70	7.20	4.20	1.80	.90	1.35	3.20	7.30
17	5.85	1.90	2.90	6.85	5.95	6.70	4.85	1.75	.90	1.80	5.80	7.45
18	5.20	1.80	2.85	6.75	6.85	8.30	4.30	1.65	.90	1.45	4.40	8.20
19	5.55	1.90	2.70	6.90	6.55	7.10	3.85	1.65	.85	1.70	7.40	8.50
20	4.00	1.85	2.65	7.10	6.40	6.65	3.90	1.55	.80	1.50	9.25	6.15
21	3.85	2.40	2.60	7.20	7.25	6.50	3.95	1.50	.70	1.45	9.45	5.35
22	3.70	2.80	2.60	6.50	7.90	6.20	4.05	1.40	.90	1.40	10.60	4.40
23	3.35	3.35	2.35	5.90	7.50	5.65	3.75	1.35	.90	1.40	7.00	4.20
24	3.75	2.85	2.20	5.25	7.10	5.10	3.40	1.30	.85	1.25	5.35	3.75
25	2.45	2.55	2.10	5.20	6.45	5.20	3.25	1.25	.80	1.15	5.80	3.35
26	3.20	2.35	2.00	5.40	6.55	6.00	3.20	1.25	.80	1.05	6.15	3.15
27	3.60	2.40	1.95	7.30	6.95	6.40	3.35	1.20	.80	.95	7.20	2.90
28	2.90	2.25	1.95	8.10	7.35	6.80	3.05	1.40	.80	.90	7.60	3.20
29	2.75	2.20	2.30	8.90	7.10	7.00	3.00	1.60	2.10	.70	6.40	3.60
30	2.70	.....	2.70	6.60	7.05	7.45	2.60	1.40	1.50	1.00	6.30	4.40
31	2.60	.....	2.50	.....	6.50	.....	2.75	1.25	.....	1.80	.....	4.15

Rating table for Skykomish River (South Fork) near Index, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.40	340	1.90	810	3.40	1,550	5.60	3,045
.50	360	2.00	855	3.50	1,605	5.80	3,205
.60	385	2.10	900	3.60	1,660	6.00	3,375
.70	410	2.20	945	3.70	1,715	6.20	3,555
.80	435	2.30	990	3.80	1,775	6.40	3,740
.90	460	2.40	1,035	3.90	1,835	6.60	3,930
1.00	490	2.50	1,080	4.00	1,900	6.80	4,130
1.10	520	2.60	1,130	4.20	2,035	7.00	4,340
1.20	550	2.70	1,180	4.40	2,175	7.50	4,890
1.30	580	2.80	1,230	4.60	2,315	8.00	5,450
1.40	615	2.90	1,280	4.80	2,455	8.50	6,050
1.50	650	3.00	1,330	5.00	2,595	9.00	6,670
1.60	685	3.10	1,385	5.20	2,740	9.50	7,320
1.70	725	3.20	1,440	5.40	2,890	10.00	7,970
1.80	765	3.30	1,495				

The above table is applicable only for open-channel conditions. It is based upon 12 discharge measurements made during 1902 and 1903. It is well defined between gage heights 1.20 feet and 8.60 feet. The table has been extended beyond these limits. Above gage height 8.80 feet the rating curve is a tangent, the difference being 130 per tenth. This is a revision of the 1903 table.

Estimated monthly discharge of Skykomish River (South Fork) near Index, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	8,750	945	2,321	142,700
February	1,522	765	1,027	59,070
March	4,670	810	1,530	94,080
April	7,450	1,058	3,682	219,100
May	5,330	2,175	3,518	216,300
June	5,810	2,665	4,047	240,800
July	4,340	1,058	2,382	146,500
August	1,255	550	805	49,500
September	900	410	532	31,660
October	855	372	553	34,000
November	8,750	535	2,552	151,900
December	6,800	1,035	2,525	155,300
The year	8,750	372	2,123	1,541,000

SNOQUALMIE RIVER NEAR SNOQUALMIE FALLS, WASH.

This station was originally established by T. A. Noble on September 14, 1902. The gage was then located below the falls, but was destroyed by the flood of December 1, 1902. On November 2 another gage was placed about 3 miles above Snoqualmie Falls post-office. The gage consisted of a plain staff graduated to feet and tenths, and reading to hundredths of a foot by means of a hook gage. The elevation of the zero on the gage was assumed to be 100.00 feet. The gage was fastened to an alder tree. January 3, 1903, this gage was washed out and on January 7 was replaced by a gage in two parts, 7 and 8 feet long, respectively. The elevation of the zero of the gage is 100.06 feet. The bench mark is on a large maple stump on the right bank. It consists of a spike driven into the stump about 4 feet from the ground. Its elevation is 127.89, or 27.83 feet above the zero of the gage. This is also the initial point for the soundings. The right bank is high and never overflows; the left bank overflows at extreme high water. The bed of the stream is of gravel and sand and is not liable to shift. The station is located below the junction of the north, south, and middle forks of the Snoqualmie River. At Snoqualmie Falls, about 4 miles below this station, the river flows over a precipice 268 feet high. Above the falls the Snoqualmie Falls Power Company has built a dam and water-power plant. The slack water from this dam reaches back from the falls about 3 miles and probably affects the flow of the river slightly at the gaging station. This is the only possible location for a gaging station which will include all three forks of the river.

On August 14, 1902, the dam below the station was raised 4 feet, backing up the water on the gage. This affected the gage height from August 14 to October 5, 1903, at which time the dam was washed out.

The observations at this station during 1904 have been made under the direction of T. A. Noble, district engineer.

Mean daily gage height, in feet, of Snoqualmie River near Snoqualmie Falls, Wash., for 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.40	2.80	2.40	3.20	4.70	5.20	5.60	1.95	1.00	1.10	1.60	4.30
2	3.40	2.60	2.25	3.20	4.40	5.00	5.65	1.90	.95	1.00	1.60	4.05
3	3.15	2.55	2.30	3.15	4.40	5.15	5.25	1.85	.80	.90	1.65	3.60
4	3.55	2.75	2.55	3.10	4.45	5.50	4.65	1.75	.80	.80	1.80	3.25
5	3.20	3.15	3.45	3.70	4.30	6.00	4.30	1.65	.80	.70	1.55	2.70
6	3.10	3.10	5.20	5.25	4.10	6.25	4.10	1.65	.80	.65	1.60	2.70
7	4.00	2.90	8.30	4.00	4.00	5.70	4.00	1.65	.80	.60	1.75	2.50
8	4.70	2.75	6.80	4.20	3.95	4.35	3.70	1.60	.90	.55	2.10	2.50
9	4.60	2.60	5.30	4.30	3.65	4.35	3.65	1.50	1.00	.65	2.00	2.60
10	4.35	2.35	4.55	4.90	3.70	4.55	3.60	1.40	1.00	.70	1.70	3.35
11	4.30	2.35	4.05	5.00	3.85	4.75	3.20	1.30	.90	.80	1.45	3.15
12	10.65	2.40	3.70	8.45	4.20	4.80	2.80	1.20	.80	1.75	1.35	2.85
13	10.75	2.40	3.45	9.80	4.90	5.25	2.70	1.20	.75	1.70	1.40	2.90
14	12.45	2.35	3.30	9.50	5.75	5.40	2.70	1.20	.75	1.30	1.20	4.60
15	5.65	2.30	3.05	8.50	5.20	5.35	2.70	1.20	.70	1.05	1.50	10.30
16	6.40	2.35	2.90	7.30	4.45	5.40	3.25	1.20	.65	1.75	3.00	6.95
17	5.95	2.20	2.90	6.05	4.75	6.40	3.20	1.15	.60	2.70	4.20	6.35
18	5.15	2.15	2.85	5.85	5.00	6.45	2.90	1.10	.60	2.00	3.90	5.25
19	4.25	2.10	2.90	5.10	5.85	6.10	2.80	1.10	.60	1.95	3.50	5.25
20	4.00	2.10	2.90	6.20	5.50	6.25	2.80	1.05	.60	1.90	12.80	5.20
21	4.00	2.10	2.70	6.90	6.20	5.40	2.80	1.00	.55	1.85	10.20	5.20
22	4.10	4.50	2.60	6.00	6.10	5.00	2.80	.95	.60	1.80	9.55	4.70
23	4.15	4.10	2.45	5.20	6.00	4.55	2.75	.90	.65	1.45	6.45	4.10
24	3.90	3.45	2.30	4.65	5.60	3.90	2.65	.90	.60	1.30	6.55	3.60
25	3.80	3.10	2.20	4.50	5.00	4.00	2.40	.85	.60	1.20	6.80	3.30
26	3.50	2.80	2.10	4.55	5.15	4.40	2.30	.85	.55	1.05	6.05	3.15
27	3.30	2.70	2.05	5.40	5.70	4.85	2.20	.85	.50	.90	6.70	3.25
28	3.10	2.60	2.60	6.65	5.70	5.10	2.05	.95	.70	.90	6.30	5.35
29	3.00	2.55	3.35	7.00	5.60	5.35	2.00	1.10	1.60	.85	5.65	7.15
30	2.85	.....	3.30	6.00	5.60	5.60	1.90	1.05	1.50	1.00	4.60	6.20
31	2.75	.....	3.25	.....	5.45	.....	1.90	1.00	.....	1.55	.....	4.75

Rating table for Snoqualmie River near Snoqualmie Falls, Wash., from January 1 to December 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.50	570	2.40	1,200	4.30	2,595	7.40	6,330
.60	590	2.50	1,250	4.40	2,690	7.60	6,610
.70	610	2.60	1,300	4.50	2,790	7.80	6,890
.80	630	2.70	1,360	4.60	2,890	8.00	7,170
.90	660	2.80	1,420	4.70	2,990	8.50	7,870
1.00	670	2.90	1,480	4.80	3,090	9.00	8,570
1.10	690	3.00	1,540	4.90	3,190	9.50	9,270
1.20	710	3.10	1,610	5.00	3,290	10.00	9,970
1.30	730	3.20	1,680	5.20	3,510	10.50	10,670
1.40	760	3.30	1,750	5.40	3,730	11.00	11,370
1.50	790	3.40	1,830	5.60	3,970	12.00	12,770
1.60	830	3.50	1,910	5.80	4,210	13.00	14,170
1.70	870	3.60	1,990	6.00	4,450	14.00	15,570
1.80	910	3.70	2,070	6.20	4,710	15.00	16,970
1.90	950	3.80	2,150	6.40	4,970	16.00	18,370
2.00	1,000	3.90	2,235	6.60	5,230	17.00	19,770
2.10	1,050	4.00	2,325	6.80	5,490	18.00	21,170
2.20	1,100	4.10	2,415	7.00	5,770	19.00	22,570
2.30	1,150	4.20	2,505	7.20	6,050	20.00	23,970

The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1902–1903. It is well defined to gage height 8.70 feet. Above gage height 6.80 feet the rating curve is a tangent, the difference being 140 per tenth.

Estimated monthly discharge of Snoqualmie River near Snoqualmie Falls, Wash., for 1904.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	13,400	1,390	3,298	202,300
February	2,790	1,050	1,394	80,180
March	7,590	1,025	1,961	120,600
April	9,690	1,610	4,215	250,800
May	4,710	2,030	3,288	202,200
June	4,970	2,235	3,567	212,200
July	4,030	950	1,799	110,600
August	975	640	741	45,600
September	830	570	630	37,500
October	1,360	580	754	46,400
November	13,890	710	3,055	181,800
December	10,390	1,250	2,887	177,500
The year	13,890	570	2,299	1,668,000

MISCELLANEOUS MEASUREMENTS IN PUGET SOUND DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in the Puget Sound drainage basin in 1901 and 1903 by J. H. Cunningham, C. E., of Portland, Oreg.:

Miscellaneous measurements in Puget Sound drainage basin.

Date.	Stream.	Locality.	Gage height.	Discharge.
			Feet.	*Sec.-feet.*
Aug. 23, 1901	Green River	Kanasket, Wash		350
Sept. 1, 1901	do	do		238
Sept. 7, 1901	do	do		196
Oct. 8, 1901	do	do	0.0	179
July 21, 1901	Nesqually River	1 mile above Elbe, Wash		773
Oct. 4, 1901	do	do	.0	352
Sept. 19, 1901	do	Highway bridge near Yelm Prairie, Wash.		565
Oct. 7, 1901	do	do	.0	483
Sept. 15, 1901	Puyallup River	Puget Sound Power Co.'s gaging station, Wash.	.8	304
Jan. 18, 1903	do	do	.0	250
Feb. 23, 1903	do	do	8.0	9,560
July 28, 1901	Skykomish River	2 miles above Index, Wash.		2,047
Aug. 26, 1901	do	do		942
Sept. 17, 1901	do	do	.0	606
Oct. 6, 1901	White River	Buckley, Wash		517

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